SCIENCE

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CONTENTS:

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*THE MIND OF PRIMITIVE MAN.**

ONE of the chief aims of anthropology is the study of the mind of man under the varying conditions of race and of environment. The activities of the mind manifest themselves in thoughts and actions, and exhibit an infinite variety of form among the peoples of the world. In order to understand these clearly, the student must endeavor to divest himself entirely of opinions and emotions based upon the peculiar social environment into which he is born. He must adapt his own mind, so far as feasible, to that of the people whom he is studying. The more successful he is in freeing himself from the bias based on the group of ideas that constitute the civilization in which he lives, the more successful he will be in interpreting the beliefs and actions of man. He must follow lines of thought that are new to him. He must participate in new emotions, and understand how, under unwonted conditions, both lead to actions. Beliefs, customs, and the response of the individual to the events of daily life, give us ample opportunity to observe the manifestations of the mind of man under varying conditions.

The thoughts and actions of civilized man and those found in more primitive forms of society prove that, in various

* Address of the retiring president before the American Folk-Lore Society, Baltimore, Dec. 27th.

groups of mankind, the mind responds quite differently when exposed to the same conditions. Lack of logical connection in its conclusions, lack of control of will, are apparently two of its fundamental characteristics in primitive society. In the formation of opinions, belief takes the place of logical demonstration. The emotional value of opinions is great, and consequently they quickly lead to action. The will appears unbalanced, there being a readiness to yield to strong emotions, and a stubborn resistance in trifling matters.

In the following remarks I propose to analyze the differences which characterize the mental life of man in various stages of culture. It is a pleasant duty to acknowledge here my indebtedness to my friends and colleagues in New York, particularly to Dr. Livingston Farrand, with whom the questions here propounded have been a frequent theme of animated discussion, so much so, that at the present time I find it impossible to say what share the suggestions of each had in the development of the conclusions reached.

There are two possible explanations of the different manifestations of the mind of man. It may be that the minds of different races show differences of organization; that is to say, the laws of mental activity may not be the same for all minds. But it may also be that the organization of mind is practically identical among all races of man; that mental activity follows the same laws everywhere, but that its manifestations depend upon the character of individual experience that is subjected to the action of these laws.

It is quite evident that the activities of the human mind depend upon these two elements. The organization of the mind may be defined as the group of laws which determine the modes of thought and of action, irrespective of the subject matter of mental activity. Subject to such laws are the manner of discrimination between perceptions, the manner in which perceptions associate themselves with previous perceptions, the manner in which a stimulus leads to action, and the emotions produced by stimuli. These laws determine to a great extent the manifestations of the mind.

But, on the other hand, the influence of individual experience can easily be shown to be very great. The bulk of the experience of man is gained from oft-repeated impressions. It is one of the fundamental laws of psychology that the repetition of mental processes increases the facility with which these processes are performed, and decreases the degree of consciousness that accompanies them. This law expresses the well-known phenomena of habit. When a certain perception is frequently associated with another previous perception, the one will habitually call forth the other. When a certain stimulus frequently results in a certain action, it will tend to call forth habitually the same action. If a stimulus has often produced a certain emotion, it will tend to reproduce it every time.

The explanation of the activity of the mind of man, therefore, requires the discussion of two distinct problems. The first bears upon the question of unity or diversity of organization of the mind, while the second bears upon the diversity produced by the variety of contents of the mind as found in the various social and geographical environments. The task of the investigator consists largely in separating these two causes and in attributing to each its proper share in the development of the peculiarities of the mind. It is the latter problem principally which is of interest to the folk-lorist. When we define as folk-lore the total mass of traditional matter present in the mind of a given people at any given time, we recognize that this matter must influence the opinions and activities of the people more or less according to

its quantitative and qualitative value, and also that the actions of each individual must be influenced to a greater or less extent by the mass of traditional material present in his mind.

We will first devote our attention to the question, Do differences exist in the organization of the human mind? Since Waitz's thorough discussion of the question of the unity of the human species, there can be no doubt that in the main the mental characteristics of man are the same all over the world; but the question remains open, whether there is a sufficient difference in grade to allow us to assume that the present races of man may be considered as standing on different stages of the evolutionary series, whether we are justified in ascribing to civilized man a higher place in organization than to primitive man. In answering this question, we must clearly distinguish between the influences of civilization and of race. A number of anatomical facts point to the conclusion that the races of Africa, Australia, and Melanesia, are to a certain extent inferior to the races of Asia, America and Europe. We find that on the average the size of the brain of the negroid races is less than the size of the brain of the other races; and the difference in favor of the mongoloid and white races is so great, that we are justified in assuming a certain correlation between their mental ability and the increased size of their brain. At the same time it must be borne in mind that the variability of the mongoloid and white races on the one hand, and of the negroid races on the other, is so great, that only a comparatively speaking small number of individuals belonging to the latter have brains smaller than any brains found among the former; and that, on the other hand, only a few individuals of the mongoloid races have brains so large that they would not occur at all among the black races. That is to say, the bulk of the two groups of races have brains of the same capacities, but individuals with heavy brains are proportionately more frequent among the mongoloid and white races than among the negroid races. Probably this difference in the size of the brain is accompanied by differences in structure, although no satisfactory information on this point is available. On the other hand, if we compare civilized people of any race with uncivilized people of the same race, we do not find any anatomical differences which would justify us in assuming any fundamental differences in mental constitution.

When we consider the same question from a purely psychological point of view, we recognize that one of the most fundamental traits which distinguish the human mind from the animal mind is common to all races of man. It is doubtful if any animal is able to form an abstract conception such as that of number, or any conception of the abstract relations of phenomena. We find that this is done by all races of man. A developed language with grammatical categories presupposes the ability of expressing abstract relations, and, since every known language has grammatical structure, we must assume that the faculty of forming abstract ideas is a common property of man. It has often been pointed out that the concept of number is developed very differently among different people. While in most languages we find numeral systems based upon the 10, we find that certain tribes in Brazil, and others in Australia, have numeral systems based on the 3, or even on the 2, which involve the impossibility of expressing high numbers. Although these numeral systems are very slightly developed as compared with our own, we must not forget that the abstract idea of number must be present among these people, because, without it, no method of counting is possible. It may be worth while to mention one or two

other facts taken from the grammars of primitive people, which will make it clear that all grammar presupposes abstractions. The three personal pronouns—I, thou, and he—occur in all human languages. The underlying idea of these pronouns is the clear distinction between the self as speaker, the person or object spoken to, and that spoken of. We also find that nouns are classified in a great many ways in different languages. While all the older Indo-European languages classify nouns according to sex, other languages classify nouns as animate or inanimate, or as human and not human, etc. Activities are also classified in many different ways. It is at once clear that every classification of this kind involves the formation of an abstract idea. The processes of abstraction are the same in all languages, and they do not need any further discussion, except in so far as we may be inclined to value differently the systems of classification and the results of abstraction.

The question whether the power to inhibit impulses is the same in all races of man is not so easily answered. It is an impression obtained by many travelers, and also based upon experiences gained in our own country, that primitive man and the less educated have in common a lack of control of emotions, that they give way more readily to an impulse than civilized man and the highly educated. I believe that this conception is based largely upon the neglect to consider the occasions on which a strong control of impulses is demanded in various forms of society. What I mean will become clear when I call your attention to the often described power of endurance exhibited by Indian captives who undergo torture at the hands of their enemies. When we want to gain a true estimate of the power of primitive man to control impulses, we must not compare the control required on certain occasions among ourselves with the control exerted by primitive man on the same occasions. If, for instance, our social etiquette forbids the expression of feelings of personal discomfort and of anxiety, we must remember that personal etiquette among primitive man may not require any inhibition of the same kind. We must rather look for those occasions on which inhibition is required by the customs of primitive man. Such are, for instance, the numerous cases of taboo, that is, of prohibitions of the use of certain foods, or of the performance of certain kinds of work, which sometimes require a considerable amount of self-control. When an Eskimo community is on the point of starvation, and their religious proscriptions forbid them to make use of the seals that are basking on the ice, the amount of self-control of the whole community, which restrains them from killing these seals, is certainly very great. Cases of this kind are very numerous, and prove that primitive man has the ability to control his impulses, but that this control is exerted on occasions which depend upon the character of the social life of the people, and which do not coincide with the occasions on which we expect and require control of impulses.

The third point in which the mind of primitive man seems to differ from that of civilized man is in its power of choosing between perceptions and actions according to their value. On this power rests the whole domain of art and of ethics. An object or an action becomes of artistic value only when it is chosen from among other perceptions or other actions on account of its beauty. An action becomes moral only when it is chosen from among other possible actions on account of its ethical value. No matter how crude the standards of primitive man may be in regard to these two points, we recognize that all of them possess an art, and that all of them possess

ethical standards. It may be that their art is quite contrary to our artistic feeling. It may be that their ethical standards outrage our moral code. We must clearly distinguish between the æsthetic and ethical codes and the existence of an æsthetic and ethical standard.

Our brief consideration of the phenomena of abstraction, of inhibition and of choice, leads, then, to the conclusion that these functions of the human mind are common to the whole of humanity. It may be well to state here, that, according to our present method of considering biological and psychological phenomena, we must assume that these functions of the human mind have developed from lower conditions existing at a previous time, and that at one time there certainly must have been races and tribes in which the properties here described were not at all, or only slightly, developed; but it is also true, that among the present races of man, no matter how primitive they may be in comparison with ourselves, these faculties are highly developed.

It is not impossible that the degree of development of these functions may differ somewhat among different types of man; but I do not believe that we are able at the present time to form a just valuation of the power of abstraction, of control and of choice among different races. A comparison of their languages, customs, and activities suggests that these faculties may be unequally developed; but the differences are not sufficient to justify us in ascribing materially lower stages to some peoples, and higher stages to others. The conclusions reached from these considerations are therefore, on the whole, negative. We are not inclined to consider the mental organization of different races of man as differing in fundamental points.

We next turn to a consideration of the second question propounded here, namely, to an investigation of the influence of the contents of the mind upon the formation of thoughts and actions. We will take these up in the same order in which we considered the previous question. We will first direct our attention to the phenomena of perception. It has been observed by many travelers that the senses of primitive man are remarkably well trained, that he is an excellent observer. The adeptness of the experienced hunter, who finds the tracks of his game where the eye of a European would not see the faintest indication, is an instance of this kind. While the power of perception of primitive man is excellent, it would seem that his power of logical interpretation of perceptions is deficient. I think it can be shown that the reason for this fact is not founded on any fundamental peculiarity of the mind of primitive man, but lies, rather, in the character of the ideas with which the new perception associates itself. In our own community a mass of observations and of thoughts is transmitted to the child. These thoughts are the result of careful observation and speculation of our present and of past generations; but they are transmitted to most individuals as traditional matter, much the same as folk-lore. The child associates new perceptions with this whole mass of traditional material, and interprets his observations by its means. I believe it is a mistake to assume that the interpretation made by each civilized individual is a complete logical process. We associate a phenomenon with a number of known facts, the interpretations of which are assumed as known, and we are satisfied with the reduction of a new fact to these previously known facts. For instance, if the average individual hears of the explosion of a previously unknown chemical, he is satisfied to reason that certain materials are known to have the property of exploding under proper conditions, and that consequently the unknown substance has the same qual-

ity. On the whole, I do not think that we should try to argue still further, and really try to give a full explanation of the causes of the explosion.

The difference in the mode of thought of primitive man and of civilized man seems to consist largely in the difference of character of the traditional material with which the new perception associates itself. The instruction given to the child of primitive man is not based on centuries of experimentation, but consists of the crude experience of generations. When a new experience enters the mind of primitive man, the same process which we observe among civilized man brings about an entirely different series of associations, and therefore results in a different type of explanation. A sudden explosion will associate itself in his mind, perhaps, with tales which he has heard in regard to the mythical history of the world, and consequently will be accompanied by superstitious fear. When we recognize that, neither among civilized man nor among primitive man, the average individual carries to completion the attempt at causal explanation of phenomena, but carries it only so far as to amalgamate it with other previously known facts, we recognize that the result of the whole process depends entirely upon the character of the traditional material: herein lies the immense importance of folk-lore in determining the mode of thought. Herein lies particularly the enormous influence of current philosophic opinion upon the masses of the people, and herein lies the influence of the dominant scientific theory upon the character of scientific work.

It would be in vain to try to understand the development of modern science without an intelligent understanding of modern philosophy; it would be in vain to try to understand the history of medieval science without an intelligent knowledge of medieval theology; and so it is in vain to try to understand primitive science without an intelligent knowledge of primitive mythology. Mythology, theology and philosophy are different terms for the same influences which shape the current of human thought, and which determine the character of the attempts of man to explain the phenomena of nature. To primitive man—who has been taught to consider the heavenly orbs as animate beings, who sees in every animal a being more powerful than man, to whom the mountains, trees and stones are endowed with life—explanations of phenomena will suggest themselves entirely different from those to which we are accustomed, since we base our conclusions upon the existence of matter and force as bringing about the observed results. If we do not consider it possible to explain the whole range of phenomena as the result of matter and force alone, all our explanations of natural phenomena must take a different aspect.

In scientific inquiries we should always be clear in our own minds of the fact that we do not carry the analysis of any given phenomenon to completion; but that we always embody a number of hypotheses and theories in our explanations. In fact, if we were to do so, progress would hardly become possible, because every phenomenon would require an endless amount of time for thorough treatment. We are only too apt, however, to forget entirely the general, and, for most of us, purely traditional, theoretical basis which is the foundation of our reasoning, and to assume that the result of our reasoning is absolute truth. In this we commit the same error that is committed, and has been committed, by all the less civilized people. They are more easily satisfied than we are at the present time, but they also assume as true the traditional element which enters into their explanations, and therefore accept as absolute truth the conclusions based on

it. It is evident that, the fewer the number of traditional elements that enter into our reasoning and the clearer we endeavor to be in regard to the hypothetical part of our reasoning, the more logical will be our conclusions. There is an undoubted tendency in the advance of civilization to eliminate traditional elements, and to gain a clearer and clearer insight into the hypothetical basis of our reasoning. It is therefore not surprising, that, with the advance of civilization, reasoning becomes more and more logical, not because each individual carries out his thought in a more logical manner, but because the traditional material which is handed down to each individual has been thought out and worked out more thoroughly and more carefully. While in primitive civilization the traditional material is doubted and examined by only a very few individuals, the number of thinkers who try to free themselves from the fetters of tradition increases as civilization advances.

The influence of traditional material upon the life of man is not restricted to his thoughts, but manifests itself no less in his activities. The comparison between civilized man and primitive man in this respect is even more instructive than in the preceding case. A comparison between the modes of life of different nations, and particularly of civilized man and of primitive man, makes it clear that an enormous number of our actions are determined entirely by traditional associations. When we consider, for instance, the whole range of our daily life, we notice how strictly we are dependent upon tradition that can not be accounted for by any logical reasoning. We eat our three meals every day, and feel unhappy if we have to forego one of them. There is no physiological reason which demands three meals a day, and we find that many people are satisfied with two meals, while others enjoy four or even more. The range of animals and plants which we utilize for food is limited, and we have a decided aversion against eating dogs, or horses, or cats. There is certainly no objective reason for such aversion, since a great many people consider dogs and horses as dainties. When we consider fashions, the same becomes still more apparent. To appear in the fashions of our forefathers of two centuries ago would be entirely out of the question, and would expose one to ridicule. The same is true of table manners. To smack one's lips is considered decidedly bad style, and may even excite feelings of disgust; while among the Indians, for instance, it would be considered as in exceedingly bad taste not to smack one's lips when one is invited to dinner, because it would suggest that the guest does not enjoy his dinner. The whole range of actions that are considered as proper and improper can not be explained by any logical reason, but are almost all entirely due to custom; that is to say, they are purely traditional. This is even true of customs which excite strong emotions, as, for instance, those produced by infractions of modesty.

While in the logical processes of the mind we find a decided tendency, with the development of civilization, to eliminate traditional elements, no such marked decrease in the force of traditional elements can be found in our activities. These are almost as much controlled by custom among ourselves as they are among primitive man. It is easily seen why this should be the case. The mental processes which enter into the development of judgments are based largely upon associations with previous judgments. I pointed out before, that this process of association is the same among primitive man as among civilized man, and that the difference consists largely in the modification of the traditional material with which our new perceptions amalgamate. In the case of activities, the

conditions are somewhat different. Here tradition manifests itself in an action performed by the individual. The more frequently this action is repeated, the more firmly it will become established, and the less will be the conscious equivalent accompanying the action; so that customary actions which are of very frequent repetition become entirely unconscious. Hand in hand with this decrease of consciousness goes an increase in the emotional value of the omission of such activities, and still more of the performance of actions contrary to custom. A greater will power is required to inhibit an action which has become well established; and combined with this effort of the will power are feelings of intense displeasure.

This leads us to the third problem, which is closely associated with the difference between the manifestation of the power of civilized man and of primitive man to inhibit impulses. It is the question of choice as dependent upon value. It is evident from the preceding remarks that, on the whole, we value most highly what conforms to our previous actions. This does not imply that it must be identical with our previous actions, but it must be on the line of development of our previous actions. This is particularly true of ethical concepts. No action can find the approval of a people which is fundamentally opposed to its customs and traditions. Among ourselves it is considered proper and a matter of course to treat the old with respect, for children to look after the welfare of their aged parents; and not to do so would be considered base ingratitude. Among the Eskimo we find an entirely different standard. It is required of children to kill their parents when they have become so old as to be helpless and no longer of any use to the family or to the community. It would be considered a breach of filial duty not to kill the aged parent. Revolting though this custom may seem to us, it is founded on an ethical law of the Eskimo, which rests on the whole mass of traditional lore and custom.

One of the best examples of this kind is found in the relation between individuals belonging to different tribes. There are a number of primitive hordes to whom every stranger not a member of the horde is an enemy, and where it is right to damage the enemy to the best of one's power and ability, and if possible to kill him. This custom is founded largely on the idea of the solidarity of the horde, and of the feeling that it is the duty of every member of the horde to destroy all possible enemies. Therefore every person not a member of the horde must be considered as belonging to a class entirely distinct from the members of the horde, and is treated accordingly. We can trace the gradual broadening of the feeling of fellowship during the advance of civilization. The feeling of fellowship in the horde expands to the feeling of unity of the tribe, to a recognition of bonds established by a neighborhood of habitat, and further on to the feeling of fellowship among members of nations. This seems to be the limit of the ethical concept of fellowship of man which we have reached at the present time. When we analyze the strong feeling of nationality which is so potent at the present time, we recognize that it consists largely in the idea of the preeminence of that community whose member we happen to be,—in the preeminent value of its language, of its customs and of its traditions, and in the belief that it is right to preserve its peculiarities and to impose them upon the rest of the world. The feeling of nationality as here expressed, and the feeling of solidarity of the horde, are of the same order, although modified by the gradual expansion of the idea of fellowship; but the ethical point of view which makes it justifiable at the present time to increase

the well-being of one nation at the cost of another, the tendency to value one's own civilization as higher than that of the whole race of mankind, are the same as those which prompt the actions of primitive man, who considers every stranger as an enemy, and who is not satisfied until the enemy is killed. It is somewhat difficult for us to recognize that the value which we attribute to our own civilization is due to the fact that we participate in this civilization, and that it has been controlling all our actions since the time of our birth; but it is certainly conceivable that there may be other civilizations, based perhaps on different traditions and on a different equilibrium of emotion and reason which are of no less value than ours, although it may be impossible for us to appreciate their values without having grown up under their influence. The general theory of valuation of human activities, as taught by anthropological research, teaches us a higher tolerance than the one which we now profess.

Our considerations make it probable that the wide differences between the manifestations of the human mind in various stages of culture may be due almost entirely to the form of individual experience, which is determined by the geographical and social environment of the individual. It would seem that, in different races, the organization of the mind is on the whole alike, and that the varieties of mind found in different races do not exceed, perhaps not even reach, the amount of normal individual variation in each race. It has been indicated that, notwithstanding this similarity in the form of individual mental processes, the expression of mental activity of a community tends to show a characteristic historical development. From a comparative study of these changes among the races of man is derived our theory of the general development of human culture. But the development of *culture* must not be confounded with the development of *mind*. Culture is an expression of the achievements of the mind, and shows the cumulative effects of the activities of many minds. But it is not an expression of the organization of the minds constituting the community, which may in no way differ from the minds of a community occupying a much more advanced stage of culture.

FRANZ BOAS.

ASSOCIATION OF AMERICAN ANATOMISTS.

THE fourteenth session of the Association of American Anatomists, meeting with the American Society of Naturalists and Affiliated Societies in Baltimore, Md., was held in the Anatomical Laboratory of the Johns Hopkins University, December 27 and 28, 1900.

The meeting was called to order, December 27th at 10:20 A.M., by President George S. Huntington.

The Executive Committee reported and recommended the names of eleven candidates for membership. Also a recommendation that at the discretion of the secretary the first five 'Proceedings,' now out of print, should be reprinted. Also a recommendation that the Association endorse the proposition for the establishment of a psycho-physical laboratory in the Bureau of Education, Washington, D. C.

By unanimous consent the secretary cast the ballot for the nominees for membership. The Association also authorized the secretary to reprint the five 'Proceedings' as recommended. The recommendation to endorse the psycho-physical laboratory was not agreed to and was referred to a committee to be appointed by the president to report at a future meeting. It was discussed unfavorably by Drs. Holmes and Hrdlicka.

The Secretary made his yearly report, which stated, among other things, that he had in hand copies of the 'Proceedings'

of the Association from the 6th to the 13th meeting, which were available for distribution to members and especially to libraries. There were 33 libraries and journals on the regular mailing list. The financial exhibit showed a balance in the treasury of $177.47; total receipts $492.25; expenditures $314.78. He suggested the desirability of having a summer meeting with the American Association for the Advancement of Science. The Association had lost several members since May, 1900, when a provisional report had been made. Professor Wm. Anderson of London, an honorary member, died Oct. 27th. Dr. A. L. T. Schäper, of Harvard Medical School, had left this country, having been appointed a professor at the University of Breslau, Prussia. There were now 116 active and 9 honorary members, total, 125.

No reports were received from the delegate to the executive committee of the Congress of American Physicians and Surgeons, nor from the committee on anatomical peculiarities of the negro, nor from the committee on table at Naples. The committee on anatomical nomenclature reported progress.

The President appointed a committee consisting of Drs. Huber, Carmalt and Barker to report nominations for delegates to the executive committee of the Triennial Congress and a new member of the executive committee of this Association.

Dr. Huntington then read the Presidential address, taking for his subject 'The Morphological Museum as an Educational Factor in the University System.'

The following papers were read:

The Use of Wet Specimens: Dr. Holmes, Philadelphia.

The cry of the general public for practicability and the desire of the recent graduate for rapid success, and strangely enough the theory of our medical schools, 'science for its own sake,' are all tending to the same point, namely, the training of students to be scientists before they have been educated as physicians. As a resultant of these forces, our medical schools are getting away from their original intent of turning out practising physicians and are evolving one-sided specialists, which again, strangely enough, the tendency to laboratory and section teaching only seems to increase, by compelling men to choose certain subjects to the exclusion of others. Following this has come a disinclination to instruct and a neglect of teaching method, so that, as has been said in anatomy, 'a man who has a book, a subject and a scalpel, ought to be able to work it all out for himself.' The most obvious improvement in our branch is the teaching in small sections; next the methodical daily apportionment of the work. If we could have our way, we would not only assign the same dissection for the same hour, but if it were possible we would have our scalpels ply together with the same unison as the violin bows in a well-trained orchestra. To be ahead of the assignment is a crime, to be behind it far better, if it implies not sloth nor ignorance, the most careless students being the most rapid slashers. Methodical and clean dissection implies a foreknowledge of the structure, but it is difficult to impress the fact that the dissecting room is a laboratory and not a library alcove, didactic reading should be done at home, the only use of the book being in connection with the cadaver. Explanations should be from the wet specimen and not merely a worded exposition. The wet specimen of muscle, artery or joint should be kept continually before the student as a pattern, to supply the defects of his own work, to study the deeper connections or to review the more superficial which must necessarily be cut away and, at the conclusion of the dissection, for a review of the whole part. Equally for the alumnus

dissector whose time is limited. With a book upon applied anatomy such hurried practitioners with a dissected subject before them can get ten times more practical benefit than could possibly be accomplished by an individual not an expert. If we were given a choice with the average man between a course of study upon the cadaver with carefully prepared wet specimens and the hacked up dissection, we should without hesitation recommend the former. For intelligent comprehension, based on sound pedagogical principles, instruct your student, first, as to what to find, and where, 'in the wet,' and then careful, neat, systematized dissection can not be done too often. For the preservation of wet specimens cold storage is by far the best, with the '*Kaiserling*' next. Alcohol hardens them too much, solutions of chloral waterlog them, formalin preparations favor mold of any part from which the fluid is allowed to evaporate.

Dr. Corson, of Savannah, Ga., not being able to be present, his paper, '*The Value of the X-ray in the Study of Normal Anatomy*,' illustrated by photographs of the human membral epiphyses at the thirteenth year, was read by Dr. Kerr of Cornell University. The paper contended that the X-ray would prove of value, first, in the study and demonstration of bone development the growth of the epiphyses, the schema of their development and the study of joints as joints, with their movements; second, in the demonstration of the internal structure of the bones; third, in the study and demonstration of the exact spacings and positions of the bones in the skeleton as a guide to its proper articulation and mounting; this would find its widest application in comparative osteology; fourth, in the study and demonstration of the arteries on the cadaver, where properly injected, they can be skiagraphed in their absolute relations to other structures. The possibility of this work is wholly due to great improvements in apparatus and technique, and without doubt we can look for even greater improvements in the future in X-ray intensity, which will widen its present field of usefulness. By the X-ray we can really watch the bones grow, and we get certain projected plans of bones and their exact positions in the skeleton which give us new ideas of function as well as of form. Thus physiology as well as morphology will benefit by the discovery of Röntgen.

The Levator Ani Muscle: DR. HOLMES, Philadelphia.

The levator ani muscle arises internal to the obturator fascia, on a line from the posterior surface of the crest of the pubes to the spine of the ischium; the fibrous leaf-lets, projecting proximal and distal to the muscle, and running downwards and inwards parallel to its fibers, being called the recto-vesical and anal fascias, which for our purpose form a sheath for the levator ani, but in reality constitute the true supporting floor of the pelvic outlet. The levator ani muscle in its origin is unique. At its insertion it is fixed only at the perineal center and the coccyx, while at the median raphe it is movable throughout, though counterbalanced by its fellow of the opposite side; and at the sphincters it is as yielding as the soft viscera themselves. None of the fibers are attached to the prostate gland, though they go behind it to join with the opposite muscle constituting a compressor as well as a levator prostatæ; so to the sphincters of the anus and of the vagina we can trace the muscular fibers, but not to the walls of the vagina nor of the rectum. The recto-vesical fascia which forms the proximal side of the muscular sheath blends with the fibrous coat of each canal, but the only direct interlacement of the muscular fibers is with the sphincters.

It would seem, therefore, as if the authors were in error in asserting that the levator ani is inserted 'into the lateral aspect of the prostate,' 'into the side of the rectum' or 'into the walls of the vagina,' but as in its origin, the muscles are attached to a narrow linear movable insertion.

It is more a tensor of the fascia, either at its origin or insertion, the fixed point being interchangeable, so that it should be called the 'Tensor perineæ' rather than 'Levator ani.'

Development of the Human Diaphragm: Dr. Mall, Baltimore. (Illustrated by diagrams and specimens.)

In human embryos four weeks old the pericardial and peritoneal cavities freely communicate. At this time, however, a ridge of tissue is formed in the wall of the cœlom opposite the ductus Cuvieri and cardinal veins which grows rapidly and encircle the lungs to form the pulmonary ridge. A week later the ridge widens to form the beginning of two membranes. The first of these, the pleuro-pericardial membrane, contains within it the phrenic nerve and soon separates the pleural from the pericardial cavity. The second, the pleuro-peritoneal membrane, grows towards the tail with the rotation of the liver and the degeneration of the Wolffian body, and at the end of the sixth week completes the diaphragm.

Dr. Stroud, of Cornell University, was unable to be present. A photograph sent by him, showing *apparatus for demonstrating the circulation of the blood*, was passed around among the members.

The apparatus is an imitation of the actual blood vascular system. The heart, arteries, capillaries and veins are represented by a rubber bulb with valves, very elastic rubber tubing; capillary glass tubing and thinner rubber tubing. The bifurcation of arteries is shown in Y-shaped, of veins by U-shaped, glass tubes. The circulation is continuous as in the living body. Manometer tubes indicate the difference in pressure in arteries and veins.

Advantages and Limits of the Methods of Reconstruction with Wax Plates in Anatomical and Embryological Investigations. Dr. Chas. R. Bardeen, Baltimore. (Illustrated by specimens, etc.)

Discussed by Drs. Huber, Minot, Barker, W. S. Miller and Huntington.

Demonstration of a New Freezing Microtome: Dr. Bardeen.

Specimen of Cyclopia: Dr. Carmalt, New York City. (With cast and photographs.)

Discussed by Dr. Minot.

A Caudal Appendage in a Human Infant: Dr. Harrison, Baltimore. (Illustrated by specimen and photographs.)

Discussed by Dr. Hrdlicka. A tail-like appendage, measuring 2¼ inches in length, was present in an infant of four months. The tail arose close to the tip of the coccyx, although not a direct continuation of the latter. It contained no cartilage nor bone, but did contain voluntary muscle fibers, and was movable to a considerable degree.

Typical Forms of Shaft of Long Bones other than the Tibia: Dr. Hrdlicka, New York City. (Illustrated by specimens.)

Discussed by Drs. Huber and Huntington. The paper presents the further results of the writer's investigations on Professor Huntington's osteological collection in the Medical Department of Columbia University, New York City. It deals with the variations in shape of long bones and classification of these shapes in a similar manner as the former (1898) communication on the tibia. An inference will be drawn as to the causes of the variation.

Notes on the First and Second Ribs and a Demonstration of Bicipital, Bicaudal, Notched and Perforated Ribs in Man; also Notes and

Articulation of Ribs with each other: DR. HRDLICKA. (Illustrated by specimens.)

Discussed by Dr. Huntington. Variations in shape of normal first and second ribs; the scalene tubercle, its frequency and real nature, and a similar tubercle on the second rib; peculiarity of the normal ossification of the cartilage of first rib. Demonstration of anomalous specimens.

Variations of the Inferior Cava: DR. HUNTINGTON. (Illustrated by photographs.)

The Origin of the Lymphatics of the Liver: DR. MALL.

When Prussian-blue gelatin in which cinnabar is suspended is injected into either the portal or hepatic vein, it is found that the blue filters through the capillary wall, leaving the red granules in the capillaries. The capillaries are surrounded by the perivascular lymph spaces which communicate with perilobular lymph spaces. These, in turn, communicate freely with the interlobular lymphatics.

The Lobule of the Lung: DR. W. S. MILLER, Madison, Wis. (Illustrated by models, diagrams and lantern slides.)

Discussed by Drs. Huntington and Huber. The term lobule as applied to the unit of the lung has been used in an exceedingly vague sense both by anatomists and pathologists. It is the purpose of the paper to give a definite meaning to the term.

The Epithelium of the Pleural Cavities: DR. MILLER, Madison, Wis. (Illustrated by lantern slides and preparations.)

Since the time of v. Recklinghausen and Oedmansson certain dark spots seen in many preparations of serous membranes stained by the silver nitrate method have been called *stomata* and *stigmata*. Ludwig and Dybkowsky described such structures in the pleura. Muscatello has recently shown that such openings do not exist normally in the peritoneum. It is the purpose of the paper to show that they do not exist in the pleura when studied in the normal condition, and that they can be produced artificially at the pleasure of the investigator.

Preliminary Report with Projection Drawings, illustrating the Topography of the Paracœles in their Relation to the Surface of the Cerebrum and Cranium: MR. E. A. SPITZKA, New York City. (Illustrated by drawings and diagrams.)

Since the tapping and injecting into the ventricles have become definite procedures in surgery, it would greatly aid the operator to have a more accurate conception of the extent, depth and contour of the cavities, with their variations, than can be had from the bare rules and measurements set forth in most surgeries. With this view the author utilizes the entire head, hardened by injection of, and submersion in, formal. After a time the cranium is opened and the brain is accurately sliced, correct drawings being made at each step and projected for the delineation of the final plates. Two heads have so far been completed. It is proposed to decalcify the skulls of subsequent material, the entire head being then subjected to the slicing method. [Published in *New York Medical Journal*, February, 2, 1900.]

Bilateral Relations of the Cerebral Cortex: DR. MELLUS, Baltimore.

Hastily reviewing bilateral relations previously demonstrated, he called attention to a series of his recent experiments on the monkey. After extirpation of a small portion of cortex from that part of the so-called motor area situated on the boundary line between facial and upper limb centers, he showed degenerated fibers passing from the lesion across the middle line in the corpus callosum. These fibers were distributed to cortical areas of the opposite hemisphere corresponding to the convolutions upon the

side of the lesion, to which association fibers were traced directly from the lesion. This distribution of association fibers to the convolutions of the two hemispheres was quite symmetrical, and by far the greater number passed to that portion of the opposite hemisphere which corresponded to the situation of the lesion. In addition to these association fibers a large portion of the degenerated tract crossing in the corpus callosum turned down into the internal capsule of the opposite side. These fibers mostly terminated in the thalamus and hypothalamus, but in a number of instances a few of these fibers passed on through the pons and medulla into the cord. Owing to the degeneration in both pyramids above the decussation, it could not be determined whether or not these fibers recrossed in the decussation. Dr. Mellus stated that after unilateral lesions in the brain of the dog he had found fibers crossing in the corpus callosum and passing down the internal capsule of the opposite side. In no instance, however, had he found these fibers in the dog passing through the capsule. They all passed out of the capsule and ended in the thalamus of the side opposite the lesion.

Methods of Statistical Study in the Dissecting Room with special reference to the Peripheral Nervous System: Dr. Bardeen. (Illustrated by charts.)

Discussed by Dr. Huntington.

Wandering of the Skin during Development, in Relation to the Distribution of Cutaneous Nerves: Dr. Harrison. (Illustrated by diagrams.)

By a process of transplantation, embryos of two species of frogs may be combined, and through contrast in pigmentation, wandering of the epidermis may be accurately observed as the embryo develops. There is a definite relation between this movement and the course of the cutaneous nerves in the adult. The wandering of the skin is, at least to a great extent, passive, and is due to mechanical causes.

Intrinsic Blood Vessels of the Kidney and their Significance in Nephrotomy: Mr. Max Brödel, Baltimore.

The pelves of most kidneys are on the posterior part of the hilum and pass obliquely forward to the center of the kidney. The calices are grouped in two rows, anterior, pointing forward, and a posterior, pointing laterally. The arteries usually divide into two main trees, an anterior, carrying three-fourths to four-fifths of the blood, and a posterior furnishing the remainder. There is neither anastomosis nor crossing between the branches of these two trunks; they are completely separated by the pelvis and its calices. The superficial and deep collecting veins of the cortex empty into the venous arches at the base of the pyramids, forming the peripheral system of venous anastomoses. There is, however, a second more central system around the necks of the calices. Practically all the veins at the hilum pass anteriorly to the pelvis. The form of the pyramids and their relations to the blood vessels and surface, and also the columns of Bertini, have been studied. Although many kidneys deviate in their construction, all conform more or less to the rules mentioned. The studies reveal several points of interest to the surgeon, among which are: (1) The most advantageous incision for nephrotomy. (2) The appropriate method of suturing an incised kidney. (3) A very satisfactory method of fixing the kidney. (4) The insufficiency of the method of opening the pelvis at the hilum.

Histology of the Endometrium: Dr. T. S. Cullen, Baltimore. (Illustrated by specimens and drawings.)

The Architecture of the Gall-bladder: Dr. M. T. Sudler, Baltimore. (Read by title.)

The Classification of Glands: DR. MINOT, Boston. (Read by title.)

Contribution to the Question of Fissural Integrality of the Paroccipital; Observations on 100 Brains: MR. SPITZKA. (Illustrated by drawings.)

Examination of 100 brains in the anatomical laboratory of the College of Physicians and Surgeons, New York City, yielded results similar to those of Professor Wilder. The question of the integrality, with the hypotheses of Cunningham, Wilder and Parker, are briefly discussed. The writer inclines to the opinion that it is not an integer, but a partial and modified segment of the simian exoccipital; and, further, that its confluence with, or separation from, the parietal should be regarded as o secondary significance and importance.

The Mesial Relations of the Inflected Fissure. Observations on 100 Brains: MR. SPITZKA. (With about 60 illustrations.)

The chief points are: (1) the normal position of the inflected fissure on the meson is caudad of the cephalic limb of Wilder's paracentral fissure in other words, its mesial portion indents and partly lies within the paracentral lobule (or as Broca prefers to call it, 'oval lobule'). (2) There is considerable confusion in modern encephalic literature concerning the synonymy of the inflected fissure. The most erroneous statements come from Eberstaller, and consist in a misinterpretation of Broca's 'incisure pré-ovalaire' and Schwalbe's 'sulcus paracentralis,' with the 'inflected fissure' of Lussana and Wilder, 'X-fissure' of Benedict and Flesch, or 'sulcus præcentralis medialis' of Eberstaller and other European writers. Broca's and Schwalbe's fissure corresponds to the cephalic limb or limiting ramus of Wilder's paracentral. (3) The condition presented in the mulatto brain described by Wilder (see Figs. 4766 and 4772 of his article, *Handbook*, Vol. VIII., 1889) is anomalous and rare, since the inflected appears wholly without the paracentral gyrus, and therefore cephalad of Broca's 'pre-oval incisure' or Wilder's cephalic paracentral limb. The explanation appears to be that the cephalic limb is obliterated, while simultaneously one of the intraparacentral elements, of which there seem to be several, has effected a junction with the paracentral stem, and thus appears, at first glance, to be a well-defined cephalic ramus.

The Brains of Two Distinguished Physicians, Father and Son; a Comparative Study of their Fissures and Gyres: MR. SPITZKA. (Illustrated by drawings and photographs.)

Discussed by Drs. Lamb and Huntington. The paper t[illegible]ats carefully and at length of the brains o[illegible]Dr. Edouard Seguin and his son, Dr. Edward C. Seguin. The learning and progressiveness of these men are well known in the educational and scientific world. Both were interested in the study of idiocy and medical thermometry; the father was especially instrumental in introducing the metric system into this country, while the son, as one of the pioneers of American neurology, made many valuable contributions to the pathology and therapeutics of nervous diseases. The brains show a general similarity and refined development, but with differences as puzzling as profound; and many interesting features appear in the comparison. So far as the author knows, this is the first instance in which the brains of blood relatives have been compared and described.

Method of Utilizing Frozen Sections for Class Demonstrations of Visceral Anatomy and the Epiphyses: PROFESSOR PRIMROSE, Toronto, Canada.

The exhibition of lantern slides was a series of photographs made from sections through the trunk and extremities of chil-

dren. The sections were prepared in a special manner so as to present a perfectly smooth surface with clear outlines of the various structures. These sections were photographed and lantern plates made from the negatives. They were cut in sagittal, coronal and horizontal planes through the trunk, and in longitudinal and transverse directions through the extremities. The method adopted in the University of Toronto is that permanent preparations are made of the sections, which are mounted in flat dishes, and thus exposed, so that they are accessible for the students at any time in the Anatomical Department. The lantern demonstration of these sections is given from time to time at the close of a lecture. It proves to be a very useful adjunct to the ordinary methods of demonstration, and the student always has the opportunity of studying the actual section in the dissecting room, the photograph of which is thrown upon the screen in the lecture theater. It is claimed that these photographs of actual sections are of much greater value from an educational standpoint than the drawings reproduced from the sections.

Method of Teaching the Anatomy of the Central Nervous System to Large Classes of Students: Dr. Barker, Chicago, Ill. (Read by title.)

D. S. Lamb,
Secretary.

THE ELEVENTH MEETING OF THE AMERICAN MORPHOLOGICAL SOCIETY.

The American Morphological Society held its eleventh annual meeting in the Anatomical Laboratory of Johns Hopkins University, on the 27th and 28th of last December. A good proportion of members was present.

The following officers were elected for the present year: *President*, J. S. Kingsley; *Vice-President*, E. A. Andrews: *Secretary-Treasurer*, Thos. H. Montgomery Jr.; *Members of the Executive Committee*, C. F. W. McClure and C. W. Hargitt. Twelve new members were elected; and the Society voted fifty dollars for the support of the University table at the Naples laboratory.

The following papers were read (abstracts of which will be published in the *Biological Bulletin*):

Fission and Regulation in Stenostoma leucops: C. M. Child.

On Gunda segmentata in America: W. C. Curtis.

Exhibition of Pacific Coast Nemerteans: W. R. Coe.

Some Disputed Points in the Anatomy of Limpets: M. A. Willcox.

The Habits and Life History of Argulus, with reference to its Economic Relations: C. B. Wilson.

A Comparative Study of the Development of the Germinative Tract of Termites: H. McE. Knower.

The Anatomy and Development of the Vena cava in Didelphys Virginiana: C. F. W. McClure.

The Crossing of the Optic Nerves in Teleosts: G. H. Parker.

A New Type of Budding in Annelids: H. P. Johnson.

Amphibian Studies: J. S. Kingsley.

Phagocytosis in a Mammalian Ovary: M. M. Metcalf.

The Mammalian Lower Jaw: W. H. Ruddick and J. S. Kingsley.

An Apparatus in the Central Nervous System of Vertebrates for the Transmission of Motor Reflexes arising from Optical Stimuli: P. E. Sargent.

The Structure of the Testis in Desmognathus fuscus: B. F. Kingsbury.

The Synapsis Stage of the Germ Cells: T. H. Montgomery, Jr.

A Study of the Phenomena of Cleavage in Etherized Eggs : E. B. WILSON.

The Influence of the Germ Cells upon the Somatic Cells: G. W. FIELD.

Two Improved Forms of Automatic Microtomes: C. S. MINOT.

A Study of the Phenomena involved in the Chemical Production of Parthenogenesis in Sea Urchins: E. B. WILSON.

Centrosomes and Spheres in the Maturation, Fertilization and Cleavage of Crepidula: E. G. CONKLIN.

Independence of the Germ Nuclei in Cleavage.

A New Method of Preservation of Fragile Specimens: A. D. MEAD.

Larval Stages and Metamorphosis of the Hermit Crab: M. T. THOMPSON.

Regeneration in Planaria maculata: C. W. BARDEEN.

Histogenesis of the Peripheral Nervous System in Salmo salar: R. G. HARRISON.

Asexual Reproduction of Planaria maculata W. C. CURTIS.

Variation in Hydromedusæ: C. W. HARGITT.

The relative Proportion of the Sexes in Poultry: G. W. FIELD.

Notes on Variation in the Shells of Purpura capillus: R. P. BIGELOW and H. S. CONANT.

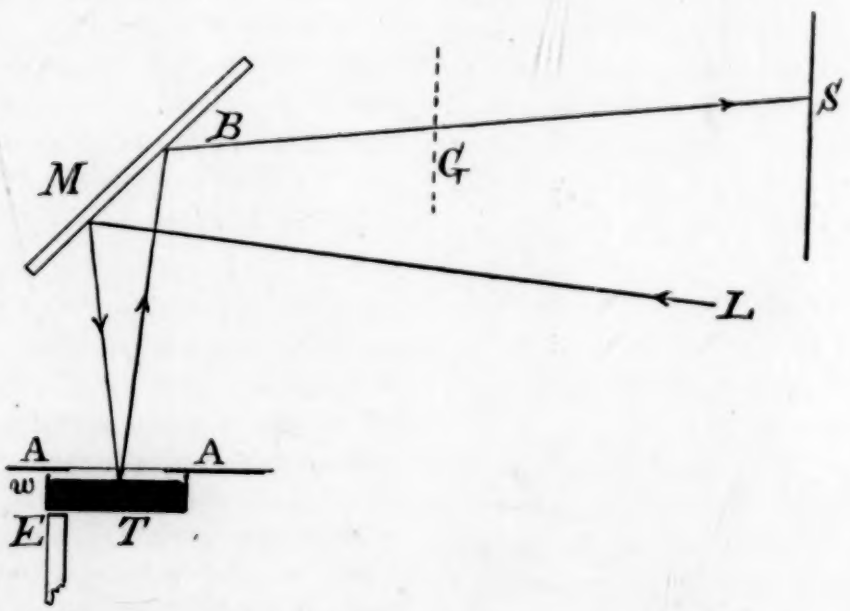
Variation and Elimination in Philosamia cynthia: H. E. CRAMPTON.

The Tentacles of Gonionemus: H. F. PERKINS.

THOS. H. MONTGOMERY, JR.,
Secretary.

THE PROJECTION OF RIPPLES BY A GRATING.

AFTER obtaining the condition under which one grating is projected by another, it seemed not unlikely that the method might be used for projection of ripples. If the latter are obtained in a trough of rectangular outline, the light reflected from them breaks up into two series of equi-



The Mesentric and Spermatic Arteries of Didelphys Virginiana: C. F. W. MCCLURE.

Observations upon the Regeneration of Renilla: H. B. TORREY.

Certain Points in the Structure of the Lower Vertebrate Brain: J. B. JOHNSON.

distant bright lines intersecting each other orthogonally. Hence the first grating* may be dispensed with, being replaced by

*See preceding article, SCIENCE, XII., pp. 617–627, October 26th, 1900. The bars of the grating *G* must be parallel to the projection of ripples at *S*, both being vertical lines like the axis of *G*.

the illuminated ripples which are then projected by the second grating. In the figure sunlight arriving at L is reflected from the large mirror M (one foot square), passing thence to and from the shallow rectangular trough T, containing mercury, to be again reflected by M, to the screen S. If a lens is placed at B, so that T is the conjugate focus of S, magnificent ripple patterns are seen on the screen whenever the table is slightly jarred by drumming on it with the fingers. These are stationary capillary waves originating at each of the straight edges of the trough. They may be obtained in different wave lengths in the ratio of 1:2, according as the table is more or less sharply rapped. Gravitational waves, though always markedly present, do not appear in the picture and may be ignored. To produce them observably it is necessary to have some special device for starting them. Two or three straight iron or steel wires, lying stably at w, on the capillary edge of the trough, are an excellent wave producer if controlled by the electromagnet E. Among interesting experiments of this kind I will only mention the reflection of waves, which advance with a crest and return with a trough, from a fixed obstacle, the lines in the image being respectively light and dark. It takes some practise, however, to see this, for with troughs as shallow as convenient the velocity will not lie much within six inches or a foot per second.

Returning from this digression, let the lens be removed and replaced by a grating, G, capable of rotation about a vertical axis. When the proper angle is obtained, a fairly sharp image of the ripples may be seen whenever the table is jarred. Care must be taken to avoid errors due to the diffraction by the grating of the light issuing from the round capillary edge of the mercury in T. These lines of light give rise to extensive streamers on the screen, intersected by sharp diffraction cross bands, the streamers intersecting each other at right angles in the patch of light due to the mercury surface proper. Hence an annular screen, AA, is added to blot out the convex edges.

If x is the (broken) distance between mercury and grating, G, if y is the distance between grating and screen, θ, the azimuth angle of G for which the image appears sharpest, finally if a is the distance apart of the ripples and b the grating space, the relation $a = b \cos\theta\,(1 + x/y)$ is available. To give an example of experiments tried in this way, I found roughly, $x = 105$ cm., $y = 670$ cm., $b = .21$ cm., $\theta = 30°$, whence $a = .2$ cm.

If the trough T is long (say two feet long and three inches broad), the waves from the end are dampened out before they reach the middle, and the cross waves are alone in presence there. These lines of light, if the long edge is parallel to the direction of projection, give sharper images. I have not yet, however, been able to develop this method to a degree useful for measurement, and I merely communicate it here as an interesting experiment. I may note, in conclusion, that if progressive instead of stationary ripples be produced, and if the grating move in a direction opposite to the ripples, with a velocity increasing until the shadow bands moving in the first instance become stationary, the velocity of the ripples would be deducible as well as their wave length.

C. Barus.
Brown University, Providence, R. I.

REVIEWS OF CURRENT BOTANICAL LITERATURE.

A little more than a year ago at the annual meeting of the Society for Plant Morphology and Physiology, held in New Haven, a committee, consisting of Dr. Farlow of Harvard University, Dr. MacDougal of the New York Botanical Garden and Dr.

von Schrenk of the Missouri Botanical Garden, was appointed to consider the question of securing better reviews of current botanical literature. A preliminary report was made by this Committee last June, at a special meeting of the Society held in New York at the time of the meeting of the American Association for the Advancement of Science. In this report the committee includes the correspondence between the secretary of the Society, Professor Ganong of Smith College, and Dr. Oscar Uhlworm of Cassel, Germany, the Editor-in-Chief of the *Botanisches Centralblatt*. Realizing that the aim of the *Centralblatt* is to publish such reviews and that it is inadvisable to multiply journals, the committee suggested some changes in the plan and management of that publication. In the words of Professor Ganong's letter:

> The chief cause of dissatisfaction with the *Centralblatt* in this country is its policy of publishing only a part of the reviews in the *Centralblatt* itself, relegating the remainder to *Beihefte*, for which a considerable additional subscription must be paid. If this were rendered necessary by the number of the reviews there could be no objection to it, but obviously the additional reviews necessitating the *Beihefte* are crowded out by the publication of the *Originalmittheilungen*. Those who subscribe for the *Centralblatt* do so for the sake of the reviews and announcements of new literature, and not for the original articles, which have no logical place in a journal devoted to reviews. The Committee feels assured that the relegation of the *Originalmittheilungen* to the *Beihefte*, or their omission altogether, and the inclusion of all the reviews in the *Centralblatt* itself would make the *Centralblatt* much more widely and completely acceptable to botanists. They believe, also, that the increased support which would be given it would compensate for any loss of subscriptions by the cessation of the *Beihefte*, and also (and this they regard as of much importance) it would tend to prevent the appearance of any competing journal.

In regard to matters of detail the committee's letter continues:

> The Committee, with other botanists, believes that the reviews of a journal devoted to communicating the appearance of new literature should be, above all, *prompt* and *descriptive*. What botanists mainly wish to learn from reviews is whether the work reviewed is important to their particular interests, and what its contribution is to the science as a whole. The abstracting of the contents of a book or paper in detail seems rather to belong to such a work as Just's *Jahresbericht*, and may well be left to it, thus shortening the descriptive reviews, and making it the easier to include them all within the limits of a journal without the need for *Beihefte*. Promptness in the appearance of reviews is particularly desirable, particularly to those who live at a distance from the place of publication.

The reply to this communication, while encouraging, was not all that the committee desired. Thus, while the editors of the *Centralblatt* were willing to confine the reviews to the journal itself, relegating the original articles to the *Beihefte*, they wished to be guaranteed a certain annual subsidy, and to still retain the right to require the subscriber to pay for both *Centralblatt* and *Beihefte*. To these stipulations the committee very properly demurred, and after discussing other proposed plans, *e. g.*, the printing of such reviews in the form of a card catalogue, or the establishment of a new journal, asked for more time for further consultation with the publishers and editors of the *Centralblatt*.

Accordingly a second interchange of letters was had, and the results were laid before the Society as a second report, in December last, during the annual meeting held in Baltimore. Professor Ganong's letter is as follows (omitting some formal matters which need not be repeated here):

> The Committee has given very careful consideration to the letter of the editors and publishers of the *Centralblatt*, and has gathered all available data from the discussions of the society and by correspondence with many botanists in America and elsewhere. As a result the Committee has to present the following

reply to the propositions contained in your recent letter:

1. You propose that, in return for certain specified changes in the *Centralblatt*, a certain annual subsidy (or else a certain number of subscriptions) to the *Centralblatt* shall be guaranteed by this Committee or by some other body of American botanists. The Committee is firmly assured that such a guarantee in either form could not secure the support of any botanical organization in this country, and hence regards it as useless to consider this point further.

2. Your offer to increase the size of the *Centralblatt* from 104 to 129 Bogen yearly does not appear to the Committee an improvement in the direction desired by American botanists. As pointed out on page 6 of the report, there is no dissatisfaction on the score of relatively insufficient attention to American literature, and hence no reason on that account for an increase in the size of the *Centralblatt*.

3. You propose to separate the *Referate* from the *Originalmittheilungen* and to publish *Referate* in one *Abtheilung*, and *Originalmittheilungen* and *Neue Litteratur* in another, the two, however, not to be obtainable separately by subscribers. While the proposed separation has certain advantages, its value is practically entirely destroyed by the condition that the two *Abtheilungen* cannot be subscribed for separately. The Committee regards it as an indispensable condition to the future active support of the *Centralblatt*, or any other journal of like aims, that it shall be possible to subscribe for *Referate* and *Neue Litteratur* without being obliged to pay for *Originalmittheilungen*, which have no logical place in a journal devoted to reviews.

4. You propose the establishment of an American Board of Editors. This proposition has been received by the Committee, and as well by the members of the Society and by other botanists, with much satisfaction. The opinion appears to be general that such a step would contribute greatly to make the *Centralblatt* acceptable to American botantists.

The Committee finds itself obliged to state, therefore, that in its opinion no change in the *Centralblatt* will make it acceptable to American botanists which does not permit of subscribing for *Referate* and *Neue Litteratur* without having to pay for *Originalmittheilungen*. If this change were made in the *Centralblatt*, and if an American Board of Editors were appointed as proposed by you, the Committee has no doubt that the minor reforms, the need for which was referred to in its former letter, could gradually and satisfactorily be brought about. Such changes would remove all reason for the existence of another and competing journal, and would, in the opinion of the Committee, attract to the *Centralblatt* an additional support which would not only compensate for any present pecuniary loss, but prove ultimately greatly to its financial advantage. The opinion appears to be nearly unanimous among botanists consulted by the Committee, that it would be far better that the *Centralblatt* should be modified to meet what appear to be but reasonable requirements in a journal devoted primarily to reviews than that a new journal should be started, and that the starting of a new journal should be resorted to only after every effort has been made to secure the desired reforms in the *Centralblatt*.

Under these circumstances the committee ventures to hope that the editors and publishers of the *Centralblatt* will take these matters again into consideration, and may be able to return a reply that will be proved a solution of all present difficulties.

To this letter, Dr. Uhlworm replied as follows:

After mature consideration of your propositions, in regard to the justice of which we have had no objections from the beginning, we have come to the conclusion to publish nothing but *Referate* and *Neue Litteratur* in the regular series of the *Botanisches Centralblatt*, which is to be of the same size and price as heretofore, and which can, of course, be subscribed for by itself. The *Beihefte*, however, which appear from time to time and may likewise be subscribed for alone, would then contain the orginal articles. In regard to the financial support of the American botanists, concerning which we had spoken only because we had concluded from your first communication that you proposed a considerable increase in the size of the *Centralblatt*, we shall of course say nothing more under the existing circumstances. We should feel deeply grateful, however, if your Committee, and especially the two gentlemen whom you select as associate editors, would give us your, support by an active cooperation, and would bring the *Centralblatt* to wider notice in America. * * * Above all things, I am naturally desirous of presenting the new American literature as rapidly and completely as possible to our readers in the future. In this connection, however, I must ask for support from you to the extent that you cause the American authors, institutions, societies and periodicals to send me a copy of newly published articles as quickly as possible for publication in *Neue Litteratur*. Written titles conduce, as I know from years of experience as a librarian and editor, only to unfortunate errors and to confusion.

It is to be hoped that a union of the American and European botanists will result in a real advance in the *Centralblatt*. I shall do all in my power to bring this about. I shall do my best to make this

joint work a most successful undertaking. I hope that I shall succeed in making similar arrangements with the botanists of other countries.

The report comments upon the foregoing as follows :

The committee feels that the Society is greatly indebted to the editors of the *Centralblatt* for their courteous letter and must be highly gratified with their statement of the changes which they express themselves prepared to make in the near future. The changes, as will be seen from Dr. Uhlworm's letter, are in conformity with the suggestions made by the committee in its report and will meet with the approval of all American botanists. It is proposed to include in the *Centralblatt* proper, only reviews and the index of literature; the *Beihefte* will contain only original articles; the *Centralblatt* may be subscribed for without also subscribing for the *Beihefte*, and, lastly, the price of the *Centralblatt* is to remain as at present. On these points, therefore, the letter of Dr. Uhlworm is entirely satisfactory.

The suggestions that American editors be nominated by a representative body of American botanists seem to be excellent and likely to prove helpful to the *Centralblatt* by stimulating our botanists to make a determined and combined effort to do all in their power to enable the editors of the *Centralblatt*, so far, at least, as American botanical literature is concerned, to make their journal indispensable to all botanists. Hereafter, it will be a matter of pride to us to show that our interest is not merely passive, but that we are ready to make active individual and collective effort to secure a desirable result.

The Committee closes its report with the following recommendations :

First, that the Secretary be directed to write to Dr. Uhlworm and express our hearty approval of the changes proposed, and our readiness to cooperate.

Secondly, that a committee of three be appointed by the Society with full power to represent the Society in further negotiations with the management of the *Centralblatt* up to such time as the selection of American editors shall have been definitely made, the committee to report to the Society at its next annual meeting.

Thirdly, that the committee thus appointed be requested to invite one botanist from the Central States and one botanist resident on the Pacific Coast to serve with them in the selection of American editors, and in such preliminary business as may be necessary for the furtherance of the plans proposed by the editors of the *Centralblatt*.

Fourthly, that a copy of this report, or of such parts of it as may seem desirable in order to call the attention of our botanists to the changes to be made in the *Centralblatt*, be sent to the *Botanical Gazette*, the *Bulletin of the Torrey Club* and to SCIENCE.

In accordance with the second recommendation, Messers. Farlow, MacDougal and Ganong were appointed upon the new committee to carry out the work to completion, and Messrs. Trelease and Campbell have since been added, in accordance with section three above. The botanists of the country are to be congratulated upon the results achieved by these negotiations. The changes proposed, and in part already put into effect, promise to make the *Botanisches Centralblatt* an efficient and economical journal of reviews indispensable to every working botanist. It is hoped that those of America will manifest their appreciation of its advantages, and their acknowledgment of the efforts of its editors and publishers to meet their wishes, by a cordial and practical support. Upon this latter subject a further communication is expected from the Committee. CHARLES E. BESSEY.

SCIENTIFIC BOOKS.

Proceedings of the Society for the Promotion of Engineering Education. Vol. VIII. 1900. Edited by PROFESSORS JOHNSON, KINGSBURY and JACOBY. New York, Engineering News Publishing Co. 1900. 8vo. Pp. 377.

It may be doubted whether, in any other department of applied science, a larger, a more important, or a more fruitful work is being done than in the field occupied by the Society of which the transactions are here recorded. The members of the Society are engaged in the technical schools and colleges of the country in the professional training of men who are to hereafter lead in the application of the discoveries of science, of the inventions of the useful arts and of the methods of modern industrial operation in the new century. Their work is the instruction of youth who, having completed the general education that their parents' money and their own time and scholarly proclivities may afford them, turn their attention to the

scientific principles which are the recognized foundation of their professional work and the basis of professional success. The work is that which has brought Germany up from insignificance, industrially, and made her one of the world's most important producers, placing her people in the foremost rank in all applied sciences and in all arts based upon science. Their opportunities are greater than those of their German colleagues; they recognize the facts and are evidently seeking to make the most of them. The record is rich in instructive and suggestive matter.

The earlier pages of the volume are given to the lists of officers, council, committees and members. The last number already—the Society was organized at the World's Congress at Chicago in 1893—nearly 300, of whom New York and Massachusetts claim 29 each; Ohio, 20; Pennsylvania, 18; Indiana and Illinois, each 15; Michigan, 13; Minnesota, 12, and other States smaller numbers; 36 States being represented, one Territory, and also Canada, England, France, Germany, Switzerland and Australia, mainly single representatives, although Canada has six. Any one occupying, or who has occupied, a position as a teacher in any branch of work in the engineering school or college is eligible to membership. The conventions occur annually and usually in conjunction, as to time and place, with the American Association for the Advancement of Science. The finances of the Society seem to be in admirable shape.

The proceedings for the year 1900 include an address by the President on the work of the nineteenth century in this field, the report of the committee appointed to answer the question, regarding industrial education generally: 'What shall it be?' an abstract of which has already been given in these columns, and a total of about twenty papers and reports of committees of a most valuable and interesting character. Those on the form of the industrial educational system, on 'Personality in Teaching' and on 'Business Methods in Teaching Engineering,' gave rise to earnest and helpful discussions of very general interest; as did, also, the two papers, coupled together, on the 'Present Status and Tendencies of Engineering Education in the United States' and on 'The Promotion of Engineering Education.' The last two papers on the list, one on 'The Modern Mechanical Laboratory,' presented simultaneously, also, to the Paris Congress on Applied Mechanics, and the other on 'Operating Work as a Feature of Electrical Laboratory Training,' were received too late for discussion.

Of these papers, the report first alluded to above, already noticed in these columns, is here printed, with a discussion of great extent and exceeding interest and in some respects perhaps more valuable than the report which provoked it. The report of the committee is strongly endorsed, and the speakers, including some of the ablest in the field, present a great variety of new views and of crucial problems such as must long afford food for thought to all interested in this subject. And what intelligent citizen is not thus interested? Heads of engineering and technical schools, practitioners, famed and expert, teachers, distinguished and likely to become distinguished, and every department of technical instruction and practise give testimony. The paper on 'Secondary Technical Education' and those on details of work may be taken to be extensions of this discussion; and most helpful they are likely to prove to all who are either directly or indirectly concerned in this most important to the industrial community of all modern departments of applied science.

R. H. Thurston.

Kant's Cosmogony. Edited and Translated by W. Hastie, D.D., Professor of Divinity in the University of Glasgow. New York, The Macmillan Co. 1900. Cr. 8vo. Pp. cix + 205. Price, $1.90.

This is an excellent bit of work, not only admirable in the scholarship and learning that go to its execution, but noteworthy in its timeliness as a contribution to English 'Kant philology.' So far as the editor is concerned, the book means that the days of heat and partisanship about the critical philosophy are past, that a man dare call attention to Kant's place in scientific evolution and yet keep a whole skin. No doubt there are those who will squirm uncomfortably when they read; Kant's 'Natural

History and Theory of the Heavens,' as he ultimately designated its exposition, will probably be regarded hereafter as the most wonderful and enduring product of his genius" (Introduction i); and will write Dr. Hastie down a philosophical Dogberry. "It is a charming incongruity to find, while Leonato rages and Benedick offers his challenge, that Dogberry is the one to unravel the tangle of threads." Our editor, untrammeled by the faction of recent schools, sees more clearly than those who, distraught by preconceived opinion, have dealt us our Kant *schillernd*. In view of their battles, it may be added that the 'Natural History' possesses this chance of future fame—it can be understood.

Some of Dr. Hastie's friends may be inclined to regret that he has elected to enlist his uncommon erudition, strong personality and vital enthusiasm in the work of making other authors known, rather than in the production of original books. This regret is mitigated, in the present case, by the fascinating 'Introduction,' which is a real addition to our literature on Kant. Indeed, Dr. Hastie has done much more than 'edit and translate,' as the modest legend runs on the title page, and the result is a highly composite production, the contents of which it were well, therefore, to set forth in detail. The book falls into three distinct portions. *First*, comes the 'Translator's Introduction,' extending to 101 pages, and divided into eight sections, as follows: (1) 'Relation of Kant's Science to his Philosophy'; (2) 'the Scientific Return to Kant'; (3) 'Kant's Scientific Environment and Antecedents'; (4) 'Kant's Discovery of the Retardation of the Rotation of the Earth'; (5) 'Kant's Natural History and Theory of the Heavens'; (6) 'Kant's Cosmogony in its Historical Relations'; (7) 'Kant's Cosmogony in Relation to Religion and Theology'; (8) 'Kant's Scientific Achievement Generally.' The appropriateness of the dedication of the book to Lord Kelvin becomes apparent on this recital. *Second*, the main body of the work, presenting (1) a translation of Kant's essay on the question (proposed by the Royal Academy of Sciences at Berlin), 'Whether the Earth has undergone an Alteration of its Axial Rotation' (1754); (2) a translation of Kant's 'Universal Natural History and Theory of the Heavens; or an Essay on the Constitution and Mechanical Origin of the Whole Universe, treated according to Newton's Principles' (1755). These translations fill 167 pages. *Third*, the Appendices, giving (1) a translation of Konrad Dieterich's 'Summary of Kant's Theory of the Heavens,' taken from his 'Kant und Newton' (1876); (2) a translation of the 'Hamburg Account of the Theory of Thomas Wright of Durham,' taken from the MS. in the library of the university of Edinburgh. This MS. is an excerpt copy transcribed from the 'Freye Urtheile und Nachrichten zum Aufnehmen der Wissenschaften,' a periodical published at Hamburg. The Wright account came in the first number of the eighth year (January, 1751). Wright's work, there summarized, was entitled, "An Original Theory or New Hypothesis of the Universe, Founded upon the Laws of Nature, and solving by Mathematical Principles the General Phenomena of the Visible Creation; and particularly the *Via Lactea*. Comprised in Nine Familiar Letters from the Author to his Friend. And illustrated with upwards of thirty graven and mezzo-tinted Plates by the best Masters. London, MDCCL." This portion is embellished with a protrait of Wright. (3) A reprint of 'De Morgan's Account of the Speculations of Thomas Wright of Durham.' This is taken from the 'London, Edinburgh and Dublin Philosophical Magazine and Journal of Science,' volume xxxii (1848). These appendices fill 38 pages.

By merely glancing over these titles, any one can infer that, if the labor involved be well done, the book constitutes a most valuable contribution to a chapter in the history of the relation between science and philosophy. As I have already said, Dr. Hastie's part is admirably sustained. Indeed, I would have scientific men, in particular, read the book carefully, for it must act as a powerful solvent upon certain unfortunate prejudices.

A word, in passing, about Wright. Like many another, so unfortunate as to live ere the times were ripe, he has been consigned to unmerited oblivion. Even the writer of the entry upon him in the 'Dictionary of National Biography'—a work so uniformly accurate—is un-

aware of the sources from which information could have been obtained, and so has nothing to tell,—does not even know the dates of his birth and death, or why he was called 'of Durham.' Wright was born at Byer's Green, near Durham, in 1711, and died there in 1786. Brought up as a 'philosophical instrument-maker,' his attention was called early to mathematico-physical problems and, by his thirty-first year, he had gained such reputation as a teacher of mathematics (like other eminent English scientists, a *private* teacher) that he was called to the chair of navigation by the Imperial Academy of St. Petersburg, an offer which he did not accept. There would seem to be no reasonable doubt that he was the first to light upon the modern physico-philosophical theory of the material universe. As De Morgan says, 'He gave the theory of the milky way which is now considered as established,' and he predicted 'the ultimate resolution of the rings of Saturn into congeries of small satellites' (203). The conclusion of Wright's seventh letter furnishes a striking instance of his remarkable prevision. "Thus, Sir, you have had my full opinion, without the least reserve, concerning the visible creation, considered as part of the finite universe; how far I have succeeded in my designed solution of the *Via Lactea*, upon which the theory of the whole is formed, is a thing will hardly be known in the present century, as in all probability it may require some ages of observation to discover the truth of it" (202). The 'ages of observation' and the Lick Observatory have not failed him. An edition of the 'Original Theory' was published in this country, at Philadelphia, by Rafinesque (1837). If Dr. Hastie had done no more than rescue this man's name from blank oblivion, he had deserved well of students of science. And he has accomplished much besides.

Apart altogether from its contribution to our knowledge of the manner in which Kant's early scientific studies influenced his later philosophical speculation—a contribution by no means inconsiderable as our somewhat scanty literature in English goes, the book ought to have distinct effect in bringing us to a clear consciousness of the close and friendly relations between science and philosophy maintained from the days of Bacon, Galileo and Descartes till broken off, during the estrangement between the German idealists and modern scientific men, since 1840. This is a long story, upon which I can not enter now. Further, it happens to have been misunderstood or forgotten till within the last few years. An earnest of better things appears to some at least to be one of the most interesting features of contemporary tendencies. To build this promise into actual fact, we need just such books as this. And, accordingly, Dr. Hastie has fairly won our warmest thanks. It is one of his greatest merits that he stands clear from all scientific and philosophical controversies, and so can state what he knows in its definite bearings, not in those which he might desire it to assume.

There must be some good hope for the future of Scottish theology when, at the university which has recently lost from its staff the most eminent living British physicist and the greatest living British Kantian scholar, the chief chair of the divinity faculty is ornamented by the occupancy of a thinker so successful in appreciative unification of the sundered learning of his famous colleagues.

R. M. Wenley.

University of Michigan.

A School Chemistry. Intended for use in High Schools and in Elementary Classes in Colleges. By John Waddell, B.A. (Dal. Coll.), B.Sc. (Lond.), Ph.D. (Heidelberg), D.Sc. (Edin.). Member of the American Chemical Society; formerly Assistant to the Professor of Chemistry in Edinburgh University; Lecturer in Chemistry in the School of Mining, Kingston.

So far as the general method of arrangement and treatment is concerned, this book is similar to others intended for the same purpose; but there are several points to which attention might be called. The author has avoided the error so often made of subordinating facts to theories, and says in the preface: "The endeavor is made in this book to help the pupil in the discovery of new facts, to enable him to see their connections, and to show how facts lead to theory and theory aids in investigation

and in the discovery of further facts. The subject is presented in what seems to me the correct perspective, theory being subordinated to fact.'' The method of treatment is the interrogatory one and an effort is made to teach the student to observe for himself. While this method is an excellent one in theory it is doubtful whether it can be used with success with a class of beginners who have had no experience in scientific methods. In the early stages of the work they must be taught how to observe, and their powers of observation must be trained by showing them what they should see in each case. In some cases the important features of the experiment might be entirely overlooked and unimportant details magnified if the attention is not directed to the desired points. Of course, this might be overcome by constant personal contact with the student ; but such is hardly possible in many institutions.

J. E. G.

BOOKS RECEIVED.

Les diastases et leurs applications. E. POZZI-ESCOT. Paris, Masson et Cie. 1900. Pp. 217.

Alcyonium. SYDNEY J. HICKSON. London, Williams & Norgate. 1901. Pp. viii + 22. 3 Plates.

Lehrbuch der vergleichenden Anatomie der wirbellosen Thiere. ARNOLD LANG. Jena, Gustav Fischer. 1901. Pp. vi + 311.

Proceedings of the Iowa Academy of Sciences for 1899. SAMUEL W. BEYER. Des Moines, F. R. Conway. 1900. Volume VII. Pp. 212.

Bibliotics or the Study of Documents. PERSIFOR FRAZER. Philadelphia, J. B. Lippincott Company. 1901. Pp. xxiv + 226.

Thirty-second Annual Report of Births, Deaths, Marriages and Divorces in Michigan. JUSTUS S. STERNS. Lansing, Robert Smith Printing Co. 1900. Pp. xvi + cixxii. Tables, 189.

Laboratory Companion. W. A. SHENSTONE. London, Edward Arnold. 1901. Pp. viii + 117.

Theoretical Mechanics. L. M. HOSKINS. Stanford University, Cal., published by the Author. 1900. Pp. x + 436. $3.25.

Reservoirs for Irrigation, Water-Power and Domestic Water-supply. JAMES DIX SCHUYLER. New York, John Wiley & Sons ; London, Chapman & Hall, Limited. 1901. Pp. xviii + 414.

SCIENTIFIC JOURNALS AND ARTICLES.

IN the January number of the *Physical Review* Theodore Lyman presents the results of a study of the 'false spectra' often produced by a Rowland concave grating. These spectra are most clearly seen in the extreme ultra-violet, and are shown to be diffraction spectra of much less dispersion than the ordinary spectra. They appear to be due to errors of ruling, extending over the whole surface of the grating. A. A. Noyes describes in the same number a modification of the usual method of determining transferrence numbers, and applies the method to a large number of salt solutions of varying concentration. The application of interference methods to the determination of Poisson's ratio forms the subject of an article by J. R. Benton ; while two articles by Chas. T. Knipp deal respectively with the employment of the bicyle wheel in illustrating the principles of the gyroscope, and with a new form of automatic temperature regulator. The former article describes a number of simple experiments with an ordinary bicycle wheel which are readily performed, and at the same time illustrate very strikingly the properties of the gyroscope and gyroscopic pendulum. Experiments are described by E. C. Roberts to determine whether the dielectric constant is altered by a magnetic field. The results are wholly negative.

THE January number of the *American Journal of Mathematics* (Vol. XXIII., No. 1), contains the following articles: 'Die Typen der linearen Complexe rationalen Curven im R_r,' by S. Kantor ; 'Transformation of Systems of Linear Differential Equations,' by E. J. Wilczynski ; 'Distribution of the Ternary Linear Homogeneous Substitutions in a Galois Field into Complete Sets of Conjugate Substitutions,' by L. E. Dickson ; 'Distribution of the Quaternary Linear Homogenous Substitutions in a Galois Field into Complete Sets of Conjugate Substitutions,' by T. M. Putnam ; 'On the Determination and Solution of the Metacyclic Quintic Equation with Rational Coefficients,' by J. C. Glashan ; 'Construction of the Geometry of Euclidean n-Dimensional Space by the Theory of Continuous Groups,' by E. O. Lovett ; 'A Table of Class Numbers for Cubic Number

Fields,' by L. W. Reid; 'On Certain Properties of the Plane Cubic Curve in Relation to the Circular Points at Infinity,' by R. A. Roberts. The number contains a portrait of the venerable ex-mathematician, George Salmon, Provost of Trinity College, Dublin.

The Popular Science Monthly for February has for its leading article 'Huxley's Life and Work,' by Lord Avebury, being the first Huxley Memorial Lecture of the Anthropological Institute of Great Britain. 'Malaria,' by Geo. M. Sternberg, being the address of the President of the Philosophical Society of Washington, gives a *résumé* of our knowledge of this subject and brings it up to date. 'A Study of British Genius,' by Havelock Ellis, is based on the Dictionary of National Biography and this, the introductory paper of a series, explains how the selections were made and gives the names of those selected. 'The Weather *vs.* the Newspapers,' by Harvey Maitland Watts, is an excellent brief exposition of the main facts of weather phenomena and of the general misunderstanding by the press and public. A brief and interesting article on 'The Philippines Two Hundred Years Ago,' by E. E. Slosson, is culled from the writings of Father Dominick Fernandez Navarette and Dr. John Francis Gemilli Careri. 'The Prehistoric Tombs of Algeria' are described by Alpheus S. Packard. Charles L. Bristol treats of 'The York Aquarium,' and in 'Chapters on the Stars,' Simon Newcomb discusses their clustering, the Milky Way, and stars with waning brightness. Finally Oliver C. Farrington, in 'A Century of the Study of Meteorites,' gives a brief summary of our knowledge of these bodies. Discussion and Correspondence comprises two contributions that especially deserve to be read, the one 'A Defense of Christian Science' as a fine example of this peculiar style of 'scientific' writing; the other 'Mr. Tesla's Science,' for its temperate criticism of certain kinds of 'science.' The departments of 'Scientific Literature and the Progress of Science' contain much good reading.

Bird Lore for February opens with an article on 'Pelican Island Revisited,' by Frank M. Chapman, with numerous and admirable illustrations from photographs by the author. 'Elliott Coues on Audubon' is a verbatim report of an address delivered by Dr. Coues before the American Ornithologists' Union in 1897, and this is followed by "Three Letters to Audubon's 'Kentucky Lads'" (his sons Victor and John), contributed by Maria R. Audubon. 'An Adirondack Lunch Counter,' with illustrations, describes the habits of some of the winter visitors. The second series of 'Birds and Seasons' discusses the birds to be met during February and March in various sections of the country, and then comes 'The Christmas Bird Census,' giving a list of the birds noted on that day at various places from Massachusetts to California and Canada to Louisiana. There is an interesting paper, by C. William Bebee, of a pair of Bald Eagles in the New York Zoo, who built a nest and have placed therein a good-sized stone on which they sit. Reviews and the department devoted to the Audubon Societies complete the number.

The Vermonter, St. Albans, Vt., C. S. Forbes, publisher, begins the year in magazine form and proposes to print monthly articles on the history, science and mineral interests of Vermont. The February number contains an interesting article on the geology of Vermont by Professor Henry M. Seely, of Middleburg College.

The University of Missouri is about to publish, under the editorship of Frank Thilly, professor of philosophy, a series of *University Studies*, containing contributions by members of the faculty and graduate students.

SOCIETIES AND ACADEMIES.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

At the 529th meeting held February 2, 1901, three reports were made of observations during the solar eclipse of May 28, 1900.

Professor S. P. Langley reported on the Smithsonian observations at Wadesboro, N. C., exhibiting many lantern slides of the apparatus used and superb photographs of the corona and sky. He stated that direct photographs were taken showing the moon 15 inches in diameter, and that the bolometric work, performed by Mr. Abbot, showed the heat from the corona to be only five eighty-fifths of that received from

the full moon. He dealt particularly with the interest that attached to further photography of the region of the sun independently of the corona, and pointed out that with a wider shadow track, such as might be expected in Sumatra in next May, there was reason to expect that stars as small as the ninth magnitude might be secured; and he showed that on a reasonable supposition as to brilliancy the diameter of such a body might be supposed to be something like the one one-hundredth part of that of Mercury, or in a rough way, one-tenth of a second on the solar disk. The observers were aided of course by irradiation in seeing this as a star, while on the surface of the sun he could say from a good deal of experience that such a body would be invisible.

The argument against the existence of a zone of such small bodies, from their never having been seen on the sun's face, was therefore inconclusive. He did not himself look forward with confidence to any new discovery being made in this direction, but he was encouraged by the opinion of a very competent adviser to think that the observation was worth repeating under better conditions. It was also desirable to repeat and extend the observations on the heat of the inner corona made at the late eclipse, and he had decided to send out a very small expedition to Sumatra in the immediate charge of Mr. C. G. Abbot, of the Smithsonian Astrophysical Observatory. The ultimate station in the interior of the island has not yet been determined.

Professor S. J. Brown, of the Naval Observatory, showed slides from some of the photographs taken by his party in North Carolina, those of the flash spectrum being specially interesting, and other slides from Mr. Burckhalter's photographs in which the outer portions of the corona had a progressively longer exposure than the inner parts.

Dr. L. A. Bauer reported on 'The Coast and Geodetic Survey, Magnetic Observations During the Late Eclipse.' Records from several stations within and without the belt of totality showed that at all of them the regular morning change of declination was interrupted very nearly at the time of totality and reversed in direction for half an hour to an hour, the average magnitude of the reversed movement being about 30 seconds, while the probable error of a reading is not over 3 seconds. At one station the intensity was observed, and here a similar reversal of the regular change was noted, amounting to three times the probable error of a reading, the intensity being diminished. No satisfactory explanation has yet been given of these reversals.

CHARLES K. WEAD,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 333d meeting was held on Saturday evening, January 26th, and was devoted to a discussion of the question of 'Former Land Connections between Asia and North America.' In introducing the subject F. A. Lucas said the questions to be considered were the existence and probable geologic time of such connections and their place, whether by way of the Aleutian Islands or across Bering Strait. The distribution of the North American sheep and brown bears, the presence of abundant and comparatively fresh remains of the northern mammoth, *Elephas primigenius* in the northwest, and the fact that the remains of a bison, *B. crassicernis*, were found in Alaska only pointed to a rather recent and brief land connection. Hints of a much earlier land connection were shown by the existence of a fossil *Nemorhedus* in Colorado and by the occurrence of the southern mammoth, *Elephas columbi*, from Oregon southwards and eastwards.

Theo. Gill said that the fossils and recent mammals pointed to a recent brief connection between the continents, but that a more ancient one was indicated by the distribution of certain fresh-water fishes. The pike, *Lucius lucius*, was common to Europe, Asia and America and the nearest allies of the American *Polyodon* and *Scaphirhynchus* were *Psephurus* and several relatives of *Scaphirhynchus* found in Asia. These fishes were of old types, while the existing Cyprinoid fishes so characteristic of the streams of North America did not occur in Asia.

W. H. Dall discussed the geology of the contiguous portions of Asia and North America, and described the hydrographic and climatic conditions existing in Bering Sea, saying that

owing to the depth of water and configuration of the bottom between the western Aleutian Islands and Asia no land connection could have taken place there. That even man could have crossed at this point on the ice was also out of the question, as the pack ice rarely reached even the easternmost islands of the chain. The speaker spoke of the conditions under which the excrement of the Mammoth was found in the body of land ice about Kotzebue Sound, as this showed that the animal actually traveled over the ice now in place. The water of Bering Strait was stated to be so shallow that it might readily have been filled with ice during the glacial period, and the Mammoth might have crossed over this ice bridge.

F. V. Coville discussed the character and distribution of the vegetation of the adjacent regions, stating that the absence of trees, common to the adjacent portions of Asia and North America, showed that there could have been no recent land communication of any long duration. The smaller plants pointed to a brief recent union of the continents.

L. Stejneger said that the genus *Alligator* of the southern United States also occurred in Asia, and the nearest relatives of the hell-bender, *Cryptobranchus*, of the eastern United States were the giant salamanders of Japan and western Asia, and that these facts indicate an old land connection of long duration. The existence of a circumpolar fauna, which had been lightly treated by previous speakers, also appeared to Dr. Stejneger to corroborate the evidence of the reptiles and batrachians.

F. A. Lucas.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

The 312th meeting was held on January 29th.

Dr. George M. Kober exhibited an antique German clock which he collected in Hesse Darmstadt. This clock, though only 125 years old, is closely patterned after the clock of Henry de Wyck (1364).

W J McGee gave an interesting account of his explorations in Sonora, Mexico, and in Southern Arizona. The search for the Tepoca Indians, relatives of the Seri, which was the principal object of the expedition, proved futile, the Tepocas recently having disappeared from their former location. Mr. McGee also visited the Cocopas living on the tide flats near the mouth of the Colorado in an isolated locality. It was observed that the Cocopas are not fishermen, though their situation offers great advantages for that pursuit. They practise agriculture in a primitive manner and make use of few introduced plants. These Indians are declining rapidly in number, the chief cause stated by Mr. McGee being the adoption of European clothing. Mr. McGee during this expedition found along the Colorado a new method of picture writing, pebbles having been removed from an even gravelly surface to form various designs.

Owing to the illness of the President, Professor W. H. Holmes, the exhibition and unwrapping of a Peruvian mummy by Professor Holmes and Walter Hough was postponed.

Major Powell's important paper on 'Philology' occupied the greater part of the evening and was discussed by Albert S. Gatschet and Alice C. Fletcher. The paper is the fourth of a series of five on Demonomy, or human activities. Major Powell in a closely reasoned paper treated of language under the heads of emotional language, oral language, gesture language, written language and logistic language. His treatment of emotional language was especially attractive. He insisted that languages were formerly more numerous than now, the tendency being toward coalescence.

At the close of the paper the discussion was participated in by P. B. Pierce, Rev. Henry M. Baum, J. H. McCormick and W J McGee.

Walter Hough.

CHEMICAL SOCIETY OF WASHINGTON.

The regular meeting was held on January 10, 1901. The following officers were elected for the ensuing year: *President*, Mr. V. K. Chestnut; *Vice-Presidents*, Dr. W. F. Hillebrand, Dr. F. K. Cameron; *Secretary*, Mr. L. S. Munson; *Treasurer*, Mr. F. P. Dewey; *Additional Members of the Executive Committee*, Dr. H. N. Stokes, Dr. H. C. Bolton, Mr. E. E. Ewell, Mr. L. M. Tolman.

William H. Krug,
Secretary.

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY OF THE NEW YORK ACADEMY OF SCIENCES.

A REGULAR meeting of the Section was held on January 28th. A paper on 'Certain Racial Characteristics of the Base of the Skull' was presented by Dr. A. Hrdlicka. The paper dealt with the middle lacerated foramen, the petrous portions of the temporal bones and the styloid. The author demonstrated the different stages of development of these parts in primates and at different stages of life in the whites, and the differences of those parts, fully developed, in the negroes, Indians and whites. In the adult whites the average middle lacerated foramen is large, the petrous portions appear considerably sunken (bulging of surrounding parts), the styloid is well developed. In the Indian the foramen is but a moderate size, in negro small, in apes absent; the petrous portions are less sunken in the Indian than in the white, on, or almost on, the level with the surrounding parts in the negro, bulging more or less beyond these in the primates; the styloid is in the majority of cases small in the negro and small to rudimentary in most of the Indians. Where the styloid is rudimentary, the vaginal process often plays a compensatory part. In whites all the mentioned stages of the parts described may be observed at different periods of life. Brain development accounts for the differences in the size of the middle lacerated foramen and the relative position of the petrous portions.

The second paper was on 'The Alsea Indians of Oregon' and was read by Dr. Livingston Farrand. The paper reported observations made by the author on the language customs and traditions of this tribe.

CHARLES H. JUDD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

FREE SPEECH IN UNIVERSITIES

RECENT events in certain American universities have again raised the old question as to the right of the professor to freedom of speech. Sensational reports in the newspapers have loosened floods of sympathy for the alleged victims of tyranny, and the popular belief is that great wrong has been done. Whether this belief is correct or not, few men are in a position to know, for the complete evidence has not been made public, and in default of that no reasonable criticism is possible. But a discussion of the principles involved in such cases is in order, and, indeed, it seems to be most necessary.

That a university professor should be free to teach his honest convictions would seem at first sight to be a most reasonable proposition. But the rights of the teacher are not absolute; they are limited by the rights of the pupils and the rights of the institution in which he is employed. The institution must protect its own dignity and reputation; the student is entitled to protection against obvious error and against the wastage of his time; and to these rights the rights of the professor are subordinate.

Suppose for example that a professor of mechanics should spend his time in teaching his class the possibility of perpetual motion. Or that the professor of mathematics should try to demonstrate in the class-room the squaring of the circle. Or that the professor of astronomy should denounce the heliocentric theory of the solar system and adopt the mediæval teachings of Cosmas Indicopleustes. His right to freedom of teaching would avail him little, and he would be promptly invited to resign his position. The right of the professor to teach is conditioned by the right of the pupil to learn, and the latter right is entitled to first consideration. The teacher has no right to teach nonsense nor to waste the time of his students over his own personal vagaries. Irresponsible freedom of speech or of teaching is plainly inadmissible; a point which certain sentimentalists have failed to see.

The present controversy, however, has not dealt with obvious questions of truth or error, but with subjects which are still under discussion and unsettled. In sociology and economics we find the chief difficulties, and here the rights of the professor are not quite so clear. Still, the responsibility on his part remains, and it cannot be honestly evaded. If a professor of sociology, speaking in his class-room, should denounce the present institution of marriage

and advocate either polygamy or free love, his honesty of purpose, his right to teach his views, would not protect him from dismissal. This is an extreme case, a case not likely to arise, but it serves to illustrate the principles at issue. All the rights of the professor are governed by reasonable limitations.

Unfortunately, at the present time, the leading economic and social questions are partly political in their nature. Their public discussion is almost wholly partisan, rarely scientific, and violent passions are easily aroused. The tariff, the coinage, the question of the so-called trusts are all alive in the public mind, and the professor of economics therefore stands on very precarious ground. What are his rights and his duties now? They are still limited, and his responsibilities are greater than ever.

Whatever a teacher may be in his private life, his personal bias is to be put under strict control the moment he enters his lecture room. There the partisan is out of place, and the interests of science rule. The professor now should cease to be an advocate, seeking to win converts, and become the equivalent of a judge who sums up the case before a jury. He must be fair, judicial, tactful and dignified; and failure in any one of these particulars is a serious limit to his usefulness. He may believe in free trade, but he should give the evidence and arguments upon both sides of the question. If he neglects to do this he defrauds the students of their rights and is a failure as a scientific teacher. He need not efface himself, he need not suppress his preferences, but he must be fair and thorough. The pupil can not understand an economic controversy without hearing both sides, and his rights in this respect are entitled to consideration. The class-room is no place for political tirades, nor for partisan denunciation, either of institutions or of individuals; it should be sacred to honest scientific discussion, regardless of parties or persons. A want of tact upon the part of the teacher, a lack of dignity in his treatment of a doubtful question, may easily become a source of trouble and justly lead to his dismissal.

That some teachers may have been unfairly treated I will not deny, for in the conflict of rights it is sometimes difficult to strike an even balance. What I have said applies to general principles, not to any special, concrete cases. Each case stands upon its individual merits, which are rarely known except to the parties who are immediately affected. The principles, however, are clear, and should be borne in mind whenever the management of a university is criticized. The latter may be in the right, despite appearances; and it is quite conceivable that a teacher may be in the wrong.

F. W. Clarke.

SHORTER ARTICLES.

THE RELATION OF SEEDINESS TO QUALITY IN MELONS.

In the *Memoirs of the Torrey Botanical Club*, Vol. 1, No. 4, issued May 30, 1890, the late Dr. E. Lewis Sturtevant contributed an article on 'Seedless Fruits' in which he presented a large amount of data compiled from various sources relative to seedless fruits as correlated with quality. Some of his statements I quote as follows: "There seems to exist in fruits a correlation between seedlessness and quality, especially when that quality is expressed by the term tenderness of tissue." "The better varieties of the apple usually contain some abortive seeds, and are sometimes individually to be found seedless. As a rule, where there is a tendency to abortive seeds, the larger and finer the apple the greater the number of abortive seeds." "Melons of the highest quality contain fewer seed than do varieties of medium or inferior quality, as I have often observed. This even seems to hold true as between individual fruits of the same variety to a marked extent."

In the autumn of 1893, my assistant, Mr. Cranefield, made a study of thirty-five musk-melons to ascertain to what extent Dr. Sturtevant's conclusions would be verified. The data have been preserved, but the results have not before been published.

These melons were the result of a cross between the Algiers cantaloupe and several American varieties. The fruits were picked when the stem readily detached, and weighed on a torsion balance that is sensitive to the

tenth of a gram. They were then cut into halves and the seeds were taken out and weighed with the adhering pulp, after which the seeds were removed from the pulp, wiped as dry as possible on a towel and weighed. The percentage of seeds was computed by dividing the weight of the seeds by the weight of the melon. The diameter of the melon was then measured, also the thickness of the flesh and of the rind. The flesh was then tested for firmness, texture and flavor. The flavor was rated on the scale of five as best.

In five melons rated poorest in flavor, the weight of the seeds averaged 1.636 per cent. of that of the melon; in five rated of best quality, the weight of the seeds averaged 1.34 per cent. of that of the melon.

In five melons of 'coarse' texture, the weight of the seeds averaged 1.764 per cent. of that of the melon; in five of 'fine' texture, the weight of seeds averaged 1.364 per cent. of that of the melon.

In five melons having the thickest flesh, the weight of the seeds averaged 1.53 per cent. of that of the melon; in five having the thinnest flesh, the weight of seeds averaged 1.54 per cent. of that of the melon.

In five of the heaviest melons, the weight of the seeds averaged 1.34 per cent. of that of the melon; in five of the lightest, the weight of the seeds averaged 1.684 per cent. of that of the melon.

It appears that so far as texture of flesh and flavor are concerned, Dr. Sturtevant's conclusions were verified.

E. S. GOFF.

WISCONSIN AGRICULTURAL EXPERIMENT STATION.

PREDETERMINED EVOLUTION.

THE American Redstart (*Setophaga ruticilla*) is structurally very widely separated from the true Redstart (*Ruticilla phœnicurus*) of Europe, and yet outwardly resembles it to an extraordinary degree. This fact has caused Professor Alfred Newton (*Ency. Brit.*, XX., 318) to write as follows: "The wonderful likeness, coupled of course with many sharp distinctions, upon which it would be impossible to dwell, between the birds of these two genera of perfectly distinct origin, is a matter that must compel every evolutionist to admit that we are as yet very far from penetrating the action of creative power, and that especially we are wholly ignorant of the causes which in some instances produced analogy."

Cases of this sort may excite our wonder, but they are much more common than is often realized. In New Mexico and Arizona we have a series of numerous species of snails, which possess shells in no way distinguishable, except in a specific sense, from those of the genus *Polygyra*, which is dominant in the eastern States. During the last two years the anatomy of several of these species has become known, and it turns out that they are not even closely allied to *Polygyra*, but represent a peculiar genus which has been named *Ashmunella* (Pilsbry and Cockerell). In Arizona and southern New Mexico there is another series of snails, which has nearly the shell of *Epiphragmophora*, a genus of the Pacific coast. The species were always referred to the last-mentioned genus until Professor Pilsbry recently dissected one of them, *E. hachitana* of Dall. It then appeared that we had here another perfectly distinct genus, which was named *Sonorella* (Pilsbry). But not only do these interesting resemblances occur between species of our continent; they are seen equally between species of different continents. Some of the California species of *Epiphragmophora* so closely resemble the European *Arionta* that naturalists were for a long time deceived. I have recently had occasion to notice the extraordinary resemblance between certain Japanese snails and those of the United States. Thus, *Eulota connivens* (Pfr.) of Japan might easily be taken for *Sonorella hachitana* of Arizona; and *Eulota mercatoria* (Gray) is remarkably similar to *Epiphragmophora fidelis* (Gray), the first being from Japan, the second from Oregon.

Is it possible that we may find a real, if imperfect, parallel between this independent development of similar species and the development of diverse cells in the metazoa? A human being, for instance, contains innumerable cells of very diverse nature, all descended directly from the ovum or germ-cell. If these cells were not parts of an organic whole, but lived separate lives, we should speak of their descent

from a primitive common ancestor (the germ-cell) and their evolution in the course of countless generations into distinct genera and species. Coues, in fact, has gone so far, in writing of bird-anatomy, as to treat the different kinds of cells as pertaining to several genera and species, which he names.

But we are here met by the extraordinary fact that all this complicated development and evolution is repeated anew in every individual, and that, speaking broadly, the course of cellular evolution is predetermined in the germ. This fact is so commonplace to us that we have ceased to realize the wonder of it, or its possible significance as a hint of the method of evolution among species.

Why may it not be that the evolution of species, to a greater or less extent, is similarly predetermined, and that here is to be found the explanation of the phenomena described in the beginning of this note? If life exists in Mars, a knowledge of it would go far toward answering such a question. How much similarity would there be between creatures evolved on two planets, with all the diversity of conditions which this implies?

T. D. A. Cockerell.

East Las Vegas, N. M.,
January 29, 1901.

NOTES ON PHYSICS.

NON-PERMANENCE OF WEIGHT.

Experiments by Heydweiller (*Phys. Zeitschr.* Aug. 25, 1900), similar to those of Landolt (*Zeit. für Phys. Chem.*, 12, p. 1, 1893), seem to show that a slight change of total weight accompanies some chemical reactions. These experiments have been interpreted by some reviewers as throwing doubt upon the axiom of the conservation of matter. This axiom is not, however, incompatible with variation of total weight in chemical or even in physical changes. If it should be found, for example, that the weight of a given amount of lead and of a given amount of oxygen varied with physical and chemical conditions, a *standard state* of lead and a *standard state* of oxygen would have to be adopted in which state these substances would always have to be weighed, and the principle of the conservation of matter would have to be stated thus: Given so much lead and so much oxygen, measured by weighing under standard conditions, then, whatever changes these substances undergo, the amount of each is found to be unchanged if both are brought back to standard conditions and weighed.

Variation of weight with physical and chemical conditions would, no doubt, throw light upon the nature of gravitation, but if such a variation becomes established it will have but little disturbing influence upon the notion of the indestructibility of matter.

In the light of Professor Fessenden's electrical theory of gravitation, it would seem that the change of state most likely to produce a change of weight would be the dissolving of an electrolytic salt in water. For, assuming electrolytic dissociation to be a separating of positively and negatively charged atoms or *ions*, the region throughout which the electric force of the atom is exerted would be greatly extended by the dissociation.

THE ELECTRO-MAGNETIC THEORY OF RADIATION.

Professor M. Planck, of Berlin, published some months ago a derivation of the formula connecting energy and wave-length in the spectrum of a black body at a given temperature, the derivation being based upon the notion of an electrical resonator enclosed in a space surrounded by perfectly reflecting walls. It is remarkable that this formula should agree with the formula of Stefan obtained by thermodynamical considerations. In the *Verhandlungen d. Deutschen Phys. Gesellschaft*, for December 1900, Professor Planck has given an outline of some work, soon to be published in full, in which he applies the method of probabilities to the determination of the partition of energy among a vast number of electrical resonators enclosed within a reflecting boundary. A consequence of the theory developed by Professor Planck, which gives some check upon its legitimacy, is a formula which permits the calculation of the number of actual molecules of any salt in a gram-molecule (the number of atoms in a gram of hydrogen), the basis of the calculation being the energy curve of the spec-

trum of a black body as determined by Lummer and Pringsheim and by Kurlbaum. It is thus found that an atom of hydrogen weighs 1.64×10^{-24} grams. Professor Planck compares this result, together with other results depending upon it, with previous approximate determinations of this quantity, and he remarks that the values determined by his formula are *not approximations*, but that the calculations are absolutely valid, provided that his theory is true.

W. S. F.

NOTES ON INORGANIC CHEMISTRY.

IN an article by Berthelot in the *Annales de Chimie et de Physique* on Egyptian gold, it appears that in the earliest epochs, argentiferous alluvial gold was used for coins and other articles. Only later, from the time of Croesus down, was the gold refined. The period of manufacture can be approximately told by analysis, owing to the rarity of minerals which yield gold free from silver. Specimens of gold from the fifth and twelfth dynasties show about four per cent. of silver, but those from the Persian epoch consist of almost pure gold.

IN a recent number of the *Chemical News*, Dr. J. H. Gladstone gives an account of analyses made of specimens of gold leaf from Egyptian mummies, supplementing the work of Berthelot spoken of above. Down to the time of the eighteenth dynasty the foil is evidently made from the native alloy, containing from four to eighteen per cent. of silver, the latter alloy closely approaching electrum. The specimens from the first dynasty show a similarity of composition, coming from a single source, but those from the later dynasties differ among themselves, and evidently had different origins. Little copper is found in any of the foils. A very thin superficial crust of chlorid of silver is found in some of the foil, indicating a slow diffusion of one part of the alloy—the silver—till it reaches the outside surface, where it meets with the chloride that exists in the sands of the desert. That the Egyptians were acquainted with different qualities of gold is evidenced by the Harris papyrus, containing the annals of Rameses III., about B. C. 1200, where mention is made of gold, pure gold, good gold, white gold, best gold, gold of the second quality, fine gold of the land, gold of the land of Koebti, and of Kush.

THE recent cases of poisoning in England from arsenic contained in beer, and the differing results obtained by the chemists who have analyzed the beer in question, have given rise to an extended discussion in the *Chemical News* and elsewhere, as to the value of the tests for arsenic which are commonly relied upon to detect and estimate the amount of arsenic in suspected substances. This discussion is well timed, for, in the whole field of toxicology, no substance is more frequently to be tested for than arsenic. The test most generally depended on is Marsh's, and this is taught in almost every laboratory, of college and medical school. As a matter of fact, while this test is thoroughly reliable in the hands of a skilled analyst, it is beset with so many difficulties, which interfere with its accuracy, that it is of little value except when carried out by a chemist who has had long experience with it; indeed in the hands of a neophyte it is often wholly misleading. This is well shown in the recent cases, where the results obtained by the different analysts were very conflicting. On the other hand, even with unskilled chemists, Reinsch's test, when properly carried out, is thoroughly to be depended on, and is under ordinary circumstances more delicate than that of Marsh. Not the least of its advantages is the fact that it requires but a short time and the simplest apparatus only. Its value is well brought out by no less an authority than A. H. Allen, writing in the *Chemical News*. It is greatly to be hoped that the present agitation will result in placing the tests for arsenic on their proper relative basis.

SOMETIME since attention was called in this column to the fact that in the examination of quite a number of canned goods, tin was found present in every instance. A paper on the same subject by F. Wirthle has appeared in the *Chemiker Zeitung*, dealing with canned meat, mostly beef. The goods were from one to five years old, and in each case tin was found, and, as was also true of the experiments above referred to by Cowan and the writer, only the

slightest trace of lead. The quantity of tin found increased from year to year, as would have been inferred from the greater corrosion in the interior of the can in the older specimens. Wirthle concludes that the tin was in the form of the basic chlorid, and due to the action of the common salt in the meat, though in one instance the sulfid of tin was found. On the other hand tin was found by Cowan in canned fruits and tomatoes, and by Weber in canned pumpkins. It is greatly to be wished that a series of experiments should be carried out with a view of determining the effect of tin in small quantities upon the human organism, for little is known of its physiological action. From the amounts which are constantly ingested with canned goods, and seemingly without injury, it is to be inferred that it has little if any deleterious action, but it would be well were this established.

In this connection, Roman and Delluc call attention in the *Journal de Pharmacie et de Chimie* to the presence of zinc in some samples of 95 per cent. alcohol examined by them. Since similar alcohol showed a reaction for zinc after being kept in contact with galvanized iron scrap for two days, the presence of the zinc in alcohol was accounted for by its having been kept, as is often the custom, in a galvanized iron vessel.

J. L. H.

THE U. S. NAVAL OBSERVATORY.

The Naval Appropriation Bill, as passed by the Senate, contains the following provisions, authorizing the appointment of a board of visitors to the Naval Observatory and incidentally requiring the superintendent to be a line officer of the Navy:

> For the expenses of the board of visitors to the Naval Observatory, two thousand dollars. There shall be appointed by the President from persons not officers of the United States a board of six visitors to the Naval Observatory, four to be astronomers of high professional standing and two to be eminent citizens of the United States. Appointments to this board shall be made for periods of three years, but provision shall be made by initial appointments for shorter terms so that two members shall retire in each year. Members of this board shall serve without compensation, but the Secretary of the Navy shall pay the actual expenses necessarily incurred by members of the board in the discharge of such duties as are assigned to them by the Secretary of the Navy or are otherwise imposed upon them. The board of visitors shall make an annual visitation to the Observatory at a date to be determined by the Secretary of the Navy, and may make such other visitations not exceeding two in number annually by the full board or by a duly appointed committee as may be deemed needful or expedient by a majority of the board. The board of visitors shall report to the Secretary of the Navy at least once in each year the result of its examinations of the Naval Observatory as respects the condition of buildings, instruments, and apparatus, and the efficiency with which its scientific work is prosecuted. The board of visitors shall prepare and submit to the Secretary of the Navy regulations prescribing the scope of the astronomical and other researches of the Observatory and the duties of its staff with reference thereto. When an appointment or detail is to be made to the office of astronomical director, director of the Nautical Almanac, astronomer, or assistant astronomer, the board of visitors may recommend to the Secretary of the Navy a suitable person to fill such office, but such recommendation shall be determined only by a majority vote of the members present at a regularly called meeting of the board held in the city of Washington. The Superintendent of the Naval Observatory shall be a line officer of the Navy of a rank not below that of captain.

This is what Senator Chandler promised as legislation to improve the management of the Observatory, but it is not likely to meet with the approval of those interested in the efficiency of the institution. A board of visitors of this character has but little real power, whereas it would serve as an excuse for any shortcomings there may be in the work of the Observatory. The board may recommend persons to fill vacancies in the staff, but it is not clear that the Secretary of the Navy is under any obligations to follow its recommendations. The astronomers apparently remain naval officers and the superintendent must be a line officer. These provisions make it still more desirable to urge the passage of Senator Morgan's bill, presented in the last issue of this Journal.

THE DEPARTMENT OF AGRICULTURE.

THE provisions reorganizing certain divisions of the Department of Agriculture which, as we noted last week, were omitted from the appropriation bill as it passed the House have been reinserted by the Senate. The four bureaus provided and the staffs, as the bill now stands, are as follows:

Bureau of Plant Industry.—One plant physiologist and pathologist, who shall be chief of bureau, $3,000; 1 plant pathologist, $2,500; 1 botanist, $2,500; 1 pomologist, $2,500; 1 agrostologist, $2,500; 1 assistant pathologist, $1,800; 1 assistant botanist, $1,800; 1 assistant pomologist, $1,800; 1 assistant agrostologist, $1,800; 2 clerks, class 3, $3,200; 3 clerks, class 2, $4,200; 3 clerks, class 1, $3,600; 5 clerks at $1,000 each; $5,000; 2 clerks at $900 each, $1,800; 2 clerks at $840 each, $1,680 in all, $39,680.

Bureau of Forestry.—One forester who shall be chief of bureau, $3,000; 1 assistant forester, $2,500; 1 assistant forester, $1,800; 1 assistant forester, $2,000; 1 chief clerk, $1,800; 1 stenographer, $1,200; 1 field assistant, $1,500; 1 field assistant, $1,400; 1 field assistant, $1,200; 1 field assistant, $1,000; 1 field assistant, $720; 10 collaborators at $300 each, $3,000; 1 clerk class 3, $1,600; 1 photographer, $1,200; 1 computer, $1,000; 3 clerks, class 1, $3,600; 2 clerks at $1,000 each, $2,000; 4 clerks at $900 each, $3,600; 7 clerks at $720 each, $5,040; in all, $39,160.

Bureau of Chemistry.—One chemist, who shall be chief of bureau, $3,000; 1 assistant chemist, $2,500; 1 assistant chemist, $1,800; 1 assistant chemist, $1,600; 2 clerks, class 1, $2,400; in all, $11,300.

Bureau of Soils.—One soil physicist who shall be chief of bureau, $3,000; 1 scientist, $2,500; 1 scientist, 1,800; 1 scientist, $1,000; 1 chief clerk, $2,000; 1 stenographer, $1,200; 3 clerks, class 1, $3,600; 1 clerk, $1,000; 1 clerk, $840, 1 watchman, $720; 1 charwoman, $480; in all, $18,140.

SCIENTIFIC NOTES AND NEWS.

THE gold medal of the Royal Astronomical Society has been awarded to Professor E. C. Pickering, director of the Harvard College Observatory.

THE Amsterdam Society for the Advancement of Natural Science and Medicine has awarded its gold Swammerdam medal for 1900 to Professor Gegenbaur, of Heidelberg. The medal was established in 1880, and is awarded once in ten years for researches in the biological sciences, having hitherto been conferred on Professor C. Th. von Siebold and Professor Ernst Haeckel.

PROFESSOR E. A. SCHÄFER, of the University of Edinburgh, was presented, on January 30th, with a testimonial by his former pupils at University College, London. The presentation took the form of silver plate and a sum of money to be used for the foundation of a Schäfer physiological research medal.

PROFESSOR MATHIAS DUVAL, of the École de Médicine at Paris, who has been obliged by the condition of his eyes to forego work for two years, has undergone a successful operation. We understand that he will now be able to resume his important embryological researches, which have already given him a foremost place among the embryologists of the world.

AT a meeting of the trustees of the American Museum of Natural History, held on February 11th, the formal announcement was made of the gift to the Museum by Mr. J. Pierpont Morgan of the Tiffany collection of gems and of the famous Bement collection of minerals. Another very important gift is the ethnological collection brought together for the past twenty-five years by Andrew Ellicott Douglas. Mr. William E. Dodge was elected first vice-president of the Museum. Professor Henry F. Osborn was elected a trustee and second vice-president.

PROFESSOR J. PLAYFAIR MCMURRICH, of the Medical Department of the University of Michigan, has been asked by the Government of the Netherlands to take charge of, and make a report on, a collection of actinians secured from the neighborhood of the Malay Archipelago. The collection includes specimens from along the shore and from the deep sea.

PROFESSOR WILLIAM DEWITT ALEXANDER, head of the survey department of Hawaii, has resigned to accept a position on the United States Coast and Geodetic Survey. He will have charge of that branch of the department which has to deal with Hawaii and Samoa.

DR. JOHN S. BILLINGS, JR., has resigned his position of instructor in clinical microscopy in the University and Bellevue Hospital Medical College, New York, and has become assistant

director of the Bacteriological Laboratory of the Department of Health.

Colonel Peter Smith Michie, professor of natural and experimental philosophy at the West Point Military Academy, died on Febru ary 16th, of pneumonia. He was born in Scotland in 1839, graduated from West Point in 1863, and has been professor there since 1871. He was the author of a number of scientific and other works, including 'Elements of Wave Motion relating to Sound and Light,' 'Elements of Analytical Mechanics,' 'Elements of Hydro-Mechanics' and 'Practical Astronomy.'

Dr. J. H. Linsley, director of the Vermont Laboratory of Hygiene, died on February 17th at the age of forty-one years.

The expedition sent by the U. S. Naval Observatory to observe the eclipse of May 17th was expected to leave San Francisco for Manila on February 16th. From Manila it will be transported to Sumatra by a U. S. warship, and headquarters will be established at Padang about a month before the occurrence of the eclipse. The party includes Professor Skinner, of the U. S. Naval Observatory; Professor Barnard, of the Yerkes Observatory; Dr. Mitchell, of Columbia University; Dr. Humphreys, of the University of Virginia, and Mr. Jewell, of the Johns Hopkins University.

It is reported in the *N. Y. Evening Post* that Mr. Marshall A. Saville, of the American Museum of Natural History, has made important discoveries in the ruins of the Palace of Mitla, in the state of Oaxaca, Mexico, his excavations having disclosed a number of chambers under the palace.

Through the efforts of Mrs. William Bouton, the St. Louis Academy of Science has secured a fine collection of native and foreign butterflies.

Mr. J. Stanley-Gardiner, M.A., fellow of Gonville and Caius College, Cambridge, has presented the university with a collection of ethnological objects from the Maldive Islands and Minikoi Island.

The Medical Department of the University of Buffalo is in receipt of a gift of $50,000 for the purpose of erecting a laboratory to be devoted to research work and to be known as the Gratwick Research Laboratory.

We learn from foreign exchanges that at a recent conference of German biologists, held at Berlin, a resolution was passed calling the attention of the Imperial Government to the importance of establishing five floating stations on the Rhine for the purpose of biological investigation. Great stress was laid on the practical advantages which pisciculture would derive from these establishments, and it was resolved that if the Government failed to provide the necessary funds, an appeal should be made to the States of Baden, Bavaria, Alsace-Lorraine, Hesse and Prussia.

Professor J. A. Fleming reports that Mr. Marconi has succeeded in sending wireless messages between St. Catharine's, Isle of Wight, and the Lizard, a distance of two hundred miles.

The Portuguese Government is sending a commission to the Portuguese possessions in West Africa to study the sleeping sickness which occurs there.

It appears that the plague is increasing in Bombay, about 1,000 deaths having occurred during the last week of which reports are at hand.

It is proposed to hold an Industrial and Polytechnic Exhibition in Birmingham during the coming summer, with the object of raising funds to endow scholarships at the University for the benefit of the children of the working classes.

The inauguration of the work of the British National Physical Laboratory has been delayed by the opposition to the site at Richmond first proposed and by the alterations required in Bushy House, the building finally granted for the laboratory. The report of the executive committee for 1900, of which an abstract is given in *Nature*, describes the building and the alterations that are in progress. Bushy House itself will be used for the more delicate physical measurements; for the engineering work a new building, 80 by 50 feet in area, will be constructed. The work in prospect for the laboratory includes the connection between a magnetic quality and the physical, chemical and electrical

properties of iron and its alloys, with a view specially to the determination of the conditions for low hysteresis and non-agency; the testing of steam gauges, indicator springs and the like, for which a mercury pressure gauge will be provided; standard screw-gauges; electrical standards, and optical, thermometric and photographic tests.

WE learn from the London *Times* that, by his will, Mr. Philip Crowley, F.L.S., F.Z.S., of Croydon, who died on December 20th last, and whose collections of birds' eggs and of exotic butterflies are among the largest known to exist, bequeathed to the Trustees of the British Museum, from his natural history collections, whether of eggs or insects or other objects, all up to four species, and of eggs, if in clutches, four clutches, and if there should be more than four specimens in his collection to allow them to take half the extra, and should any species be useful or interesting by reason of variety or locality to allow them to take the whole series if they should think fit so to do—his idea being that what was really useful and wanted they might have, but that they should not take simple duplicates.

PENNSYLVANIA is a good second to New York in the forestry movement. Already it has secured 150,000 acres for its State forestry reservations. It will probably have 500,000 acres before the year ends, and looks forward to the acquisition of 1,500,000 or 2,000,000 acres. Its State College is now preparing to begin teaching practical forestry, and a bill has just passed the second reading in the House of Representatives which provides for the creation of a State Department of Forestry which shall be of equal importance with any other department of the Government. For years a campaign of education has been conducted in that State on very liberal lines, and it is largely to this that the popularity of forestry in Pennsylvania is due.

SANITARY science has scored two points of advantage during the month of January in two decisions of the New York Supreme Court, which make the pollution of streams by municipal corporations and private concerns actionable. Judge Houghton in General Term has granted an injunction against the city of Gloversvill for discharging its sewage into th Cayadutta creek, a tributary of Mohawk river. The Appellate Division has also affirmed the decision of Judge Stover in General Term, granting an indemnity against the Geo. West Paper Co., of Ballston, N. Y., for the pollution of the Kayaderosseras creek, a tributary of the Hudson river. Both suits were brought by private riparian owners, the former in spite of a bill passed by the New York Legislature of 1900, giving the city of Gloversvill the right of disposal now denied it by the Court.

A LAW has recently been passed which permits the French Government to forbid the manufacture and sale of absinthe and certain other fabricated articles of drink, recognized and declared to be dangerous by the Academy of Medicine. The Chamber has now voted to request the Academy to indicate those drinks which contain substances dangerous to the public health, so that their manufacture and sale may be prohibited.

THE Right Honorable R. W. Hanbury M.P., President of the Board of Agriculture, has appointed a committee for the purpose of conducting experimental investigations with regard to the communicability of glanders under certain conditions, and as to the arresting and curative powers, if any, of mallein when repeatedly administered. The committee will consist of Mr. A. C. Cope, chief veterinary officer of the Board of Agriculture (chairman); Professor J. McFadyean, principal of the Royal Veterinary College; Mr. William Hunting, one of the veterinary inspectors of the London County Council; Mr. J. McIntosh McCall, assistant veterinary officer of the Board of Agriculture; Mr. H. A. Berry, of the Board of Agriculture, will act as the secretary to the committee.

BEFORE the Pan-American Medical Congress, which met recently at Havana, the board which has been engaged in the investigation of yellow fever, consisting of Drs. Reed, Carroll and Agràmonte, made a report. According to despatches to the daily papers, it was stated that two of the main conclusions were that the specific cause of the disease is unknown, and that it can be carried only by mosquitoes. Conse

quently the disinfection of clothing and houses is useless. The fever can be produced by a subcutaneous injection of blood from a patient who must have had the disease for not more than two days. Mosquitoes must also bite the patient during the first two days of his illness or they cannot transmit the disease. The board kept an infected mosquito for fifty-one days, when it was allowed to bite a person who contracted the disease. The board differs from Dr. Finlay in that the latter holds that more than one kind of mosquito can convey yellow fever. The board says there is only one kind that can do so. Dr. Finlay also says that a mosquito can transmit the disease the fourth or fifth day after biting a patient, while the board says that twelve days must intervene. The board reported that non-immunes were allowed to sleep in infected clothing and bedding, but none contracted the disease. A member of the Congress objected that these so-called non-immunes might really have been immunes. The board replied that two of these were subsequently subjected to the bites of infected mosquitoes and contracted the disease. The moral aspect of the experiments was touched upon. It was pointed out that members of the board were themselves bitten and one of them died. Yellow fever is not due to dirt. It may occur in the cleanest localities. Dr. Wilde of the Argentine Republic proposed the creation of an international yellow fever board to study means of exterminating the disease.

The Illinois Society of Engineers and Surveyors held its sixteenth annual meeting at Bloomington on January 23d–25th.

At a meeting in San Francisco a committee of fifteen was authorized for the preparation of plans for a Pacific Coast Medical Association.

A conference of science masters in public schools was held recently in the rooms of the University of London, at South Kensington, with Sir Henry Roscoe in the chair and about fifty members in attendance. The subjects discussed included the order of science teaching, the coordination of the teaching of science and mathematics, natural history societies, and science and examinations.

The Council of the St. Louis Academy of Science announces that it has arranged for a series of addresses on the progress made in the several departments of pure and applied science during the nineteenth century. These addresses, to which the public is welcome, are given at the Academy Rooms, 1600 Locust street, at the second stated meeting of each month, at 8 P. M. Subject to revision due to unforeseen causes, the following program is announced for these meetings:

January 21st, Rev. M. S. Brennan, 'Astronony.'
February 18th, Professor J. L. Van Ornum, 'Engineering.'
March 18th, Dr. E. H. Keiser, 'Chemistry.'
April 15th, Mr. C. F. Marbut, 'Geology.'
May 20th, Professor George Lefevre, 'Zoology.'
October 21st, Professor F. E. Nipher, 'Physics.'
November 18th, Mr. Herbert F. Roberts, 'Botany.'
December 16th, Mr. F. Louis Soldan, 'Education.'

The public lectures under the auspices of the department of zoology of Columbia University are being given this year by Dr. Gary N. Calkins, the dates and titles being:

February 15—'The Simplest of Living Animals. General Sketch.'
February 19—'The Sarcode Animals; Naked bits of Protoplasm.'
February 26—'The Flagellated Organisms, the Most Important Group, theoretically, of the Protozoa.'
March 1—'The Malarial Germ and other Sporozoa.'
March 5—'Infusoria, the Highest Type of Protozoa.'
March 8—'The Loss of Vitality in Protozoa and its Renewal through Conjugation.'
March 12—'The Protozoon, a Physiological Machine.'

Professor Nipher, of Washington University, is still making progress in his photographic work. If his pictures are unsatisfactory on first development, he destroys the picture chemically and starts again with a clean film. If the picture is started as a negative in the dark room and is unsatisfactory, he first dissolves the picture with the fog on the plate, then a fresh picture is developed on the same film. This picture may be a negative in the dark room, or it may be a positive, if the development takes place in the light. In a similar way, if the first picture is a positive, the second picture may be either a positive or a negative, according as the second development is in the light or in the dark room. There is a great advantage in start-

ing the secondary treatment with a clear film. A picture started as a negative may be reversed by turning on the light, but the high lights are already dark and the shadows must then become dark in contrast with them. The whole picture will then be very dark. By this new process the second picture may be as perfect as if the original treatment had been properly started.

THE directory of the Washington Academy of Sciences and affiliated societies for 1901, compiled by Dr. Marcus Baker, and corrected to about January 10th, has been distributed to members. The membership of the societies, excluding corresponding members in some cases, is 2,557 and the number of persons 2,013. The membership is distributed among the different societies as follows:

Academy of Sciences	291
Anthropological Society	125
Biological Society	171
Chemical Society.	121
Entomological Society	52
National Geographic Society.	1059
Geological Society	147
Columbia Historical Society	180
Medical Society	309
Philosophical Society	102

THE American Metrological Society has issued a circular, primarily for distribution among members of Congress, entitled 'A Few Reasons Why the Metric System of Weights and Measures should be Adopted in the United States.' It presents very clearly the great advantages of the metric system and should be widely circulated. Copies can probably be obtained from the president of the Society, President T. C. Mendenhall, Worcester, Mass., or the secretary, Professor J. H. Gore, Columbian University, Washington, D. C.

IT is proposed in Dundee to erect a granite monument over the grave of James Bowman Lindsay, in the Western Cemetery of the city. *Nature* calls attention to the fact that Lindsay was a remarkable man, whose memory should not be permitted to fade. He was born in 1799, and taught electricity, magnetism and other subjects in Dundee for many years, dying there about forty years ago. In 1834 he foresaw that 'houses and towns will in a short time be lighted by electricity instead of gas, and machinery will be worked by it instead of steam.' This prediction was the result of his own observations of effects produced by the electric current, and not merely imaginative suggestions. In 1854 Lindsay transmitted telegraphic signals through water electrically; and when the British Association visited Aberdeen in 1859, he demonstrated the success of his method by transmitting signals across the harbor. He also read a paper upon it, entitled, 'Telegraphing without wires.'

IT is stated in the *Lancet* that, in consequence of a movement which was started two years ago, a salmon hatchery for the river Tweed has just been erected. The hatchery, which is fitted with all the modern improvements, is situated at East Learmouth, about a mile from Cornhill-on-Tweed, on an excellent site which has been granted by Earl Grey. The management of the hatchery is under the supervision of Mr. F. J. Douglas, Springwood Park, Kelso, and Mr. George Grey of Millfield. The hatchery is a private undertaking with which the River Tweed Commissioners have no official connection, and the cost of which has been subscribed to by every river proprietor from Torwoodlee to Tillmouth. The building is 48 feet long by 20 feet wide and seven feet high inside. It is fitted with 12 boxes capable of holding in all 18 grilles, so that the 12 boxes combined have a capacity for about 300,000 salmon ova. If the fry were hatched three times in a season the output would not fall far short of 1,000,000 salmon fry. The water supply is carefully filtered before passing into the boxes. There is in the hatchery an impounding tank of 1,100 gallons capacity for keeping the salmon in after capture until they are ready for spawning. The young fry will be kept until they are six months old. For this purpose six ponds are to be constructed 40 feet long by eight feet wide by four feet deep. There are those who think that fish-culture may play an important part from a medical point of view in the future.

THE Prussian Minister of Public Instruction has issued an order regulating experiments in hospitals which is quoted by the London *Times* as follows: "I hereby call the attention of those who have the management of clinical and

polyclinical hospitals and similar institutions to the fact that medical operations for any purposes save those of the diagnosis, cure, and prevention of disease are forbidden, even when otherwise permissible from the legal and moral point of view—(1) in the case of a person who is a minor or for other reasons is not entirely responsible; (2) in cases where the person in question has not explicitly given permission for the operation; (3) in cases where this permission has not been preceded by a proper statement of the injurious consequences which might possibly result from the operation. I likewise order that operations of this nature shall be undertaken only by the director of the institution himself or by his special authorization. Whenever such an operation is performed the register of the case must contain a statement that the above conditions have been fulfilled, and must also give a detailed account of the circumstances. The existing regulations affecting medical operations for the purposes of the diagnosis, cure, or prevention of disease are not affected by these instructions."

UNIVERSITY AND EDUCATIONAL NEWS.

By the will of the late Professor Edward Edridge Salisbury, Yale University will receive on the death of Mrs. Salisbury a certain part of the residue of the estate, the amount being estimated at $150,000. One-half of the sum is to provide an additional income for the Salisbury professorship of Sanskrit and comparative philology, and the other half is to accumulate until it reaches $100,000, when the income is to be used for such purpose as the trustees may determine.

By the will of the late J. A. Vanderpoel, Rutgers College will receive $25,000 on the death of Mrs. Vanderpoel, the money to be used for scholarships in chemistry.

A bill has been introduced at Albany providing for the establishment of a State electrical school at Schenectady, which would be a part of Union College. The bill appropriates $150,000 for the establishment of the school and $25,000 for maintenance. Union College is to offer 100 scholarships and the General Electrical Company is to give the use of its shops for observation and instruction.

A bill has also been introduced at Albany appropriating $100,000 for the establishment of a State Veterinary College for the eastern part of the State to be consolidated with the College of New York University.

The Paris faculty of medicine has established a school for the study of tropical diseases, with special chairs of bacteriology and parasitology.

A memorial to the Secretary of State for India, begging for an inquiry into the recent dismissal of seven of the staff of Coopers Hill College, has been signed by Lord Kelvin, Lord Lister, Lord Rayleigh, Sir Frederick Abel, Sir Frederick Bramwell, Sir William Huggins, Sir Norman Lockyer, Sir Andrew Noble, Sir William Crookes, Sir Archibald Geikie, Sir Henry Roscoe, Professor Dewar, Professor J. J. Thomson, Professor Armstrong, Professor Marshall Ward, Professor Ewing, Mr. W. H. M. Christie, Mr. R. T. Glazebrook, Mr. W. N. Shaw, and by some seventy other Fellows of the Royal Society.

At the Rush Medical College, University of Chicago, Dr. G. S. Lingle has been appointed professor of experimental physiology, and Dr. W. D. Zoethout laboratory professor of neurology.

It is reported that Professor Frank Thilly, of the University of Missouri, has been offered the chair of ethics at Leland Stanford Junior University.

At the Massachusetts Institute of Technology the following promotions have been made: Dr. Henry Fay, assistant professor of analytical chemistry and metallography; Dr. James F. Norris, assistant professor of organic chemistry; Dr. F. H. Thorp, assistant professor of industrial chemistry, and Dr. W. R. Whitney, assistant professor of theoretical chemistry and proximate analysis. In the department of physics, Messrs. L. Derr, C. L. Norton and Dr. G. V. Wendell have been promoted to assistant professorships.

Dr. F. Schenck, of Würzburg, is to succeed Kossel as professor of physiology at Marburg.